The Chemical Age

VOL LXIII 8 JULY 1950 No 1617

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•• COMPUTATION ••

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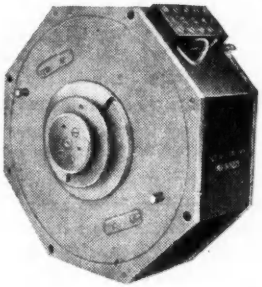
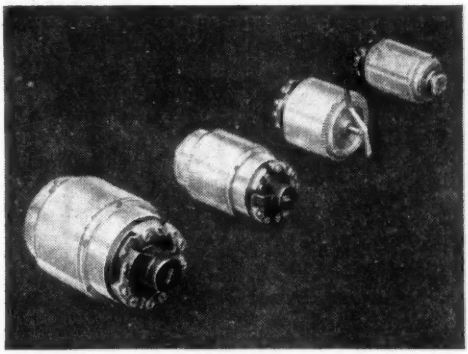
SUPPLY : 50V 50 c/s





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Coal and the Chemist

THE annual reports of the National Coal Board, of which the fourth was issued last weekend,[1] are revealing, this year's disclosing, in particular, a solid measure of recovery from an apparently chronic state of small production and high costs. The report unfortunately leaves unsaid many of the things which specialists hoped to read.

Chemists and chemical manufacturers are interested in this last report mainly from three aspects. Like others in industry, they want clean coal at a reasonable price. Secondly, they are on the watch for an approach to the fuller chemical processes based on coal which they can introduce as soon as the present shortage conditions are banished. Finally, they want to know the extent to which scientific methods are being applied in the coal industry.

To the last of these questions the report gives as full and frank an answer as its space permits. A divisional scientific service analyses mine air and roadway dust (1,300,000 samples in 1949), prepares specifications for store, keeps an eye on effluent quality, besides carrying on its basic duty of systematic control of the quality of coal marketed. Chemists in this service also assist in technical control of coke ovens, by-product plants and brickworks. Physical and chemical studies of the coal in seams is carried out by the Coal Survey organisation which is also a part of the Board. Since 1948 an operational research group has been carrying on investigations; their activities are adequately reported but concern mainly mining engineering and organisation. The same year saw the formation of the Central Research Establishment at Stoke Orchard, near Cheltenham. Studies in this research station, however, form only a part of the Board-sponsored researches. Wisely, the NCB finances, and takes some part in directing, the work of some other associated research organisations. Among them is the Coal Tar Research Association, whose potential scope is discussed in this issue (pp. 51-54). Each of these organisations issues its own reports, but it would greatly improve any assessment of coal prospects as a whole if a little more space were allotted in the Coal Board's own report to indicate broad lines of work in both sponsored and unsponsored organisations.

Then, to return to the second aspect mentioned, the report in its familiar form gives no indication of chemical

On Other Pages

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and allied processes based on coal other than work on carbonisation, which in general will not interest manufacturers. The more intimate picture is again left to the Fuel Research Station, from which comes most material on coal hydrogenation and solvent extraction work. No mention of these is made in the report. It is true that the Scientific Member, Sir Charles Ellis, F.R.S., has recently lectured on contemporary research on coal,[2] but he confined himself to discussion of the fundamental structure of the coal substance. The time may now be ripe, however, to consider whether a separate publication might be justified in the light of the extent of extractive processes, outlining all research on and around Great Britain's premier mineral.

Not only processes but instruments developed may also be of general value. Rapid measurements of dust smaller than five microns in diameter are claimed to be possible with a new sampling and analysis instrument. The equipment for rapid determination of methane in mine air sounds as though it could be adopted for other industrial gases with high infra-red absorption. Samples for gas analysis are taken by small hand pump, stored in a metal cylinder (obviating the old glass breakage nuisance) and are then analysed instantaneously on an infra-red absorption apparatus. The methane content is read on a dial. Similarly, a new proportioning device for measuring out detergents in dust suppression work may well have use far beyond this first restricted field for which it was developed.

Tucked away in a section devoted to mining engineering is a reference to another matter of interest to chemists. In gassy pits, the methane—instead of remaining as a source of explosive danger—may be drained off. For the present it is used as a boiler fuel, being piped to colliery boilers. It is difficult to believe that this will remain as the sole field of use.

Coal utilisation is studied by the British Coal Utilisation Association, to which the Board is the largest subscriber. The general scope of its researches is outlined in a paragraph of the report. Most coal users would be interested to know, however, if a scientific investigation has been made to determine whether the continued large proportion of dirty coal was unavoidable or how it could be minimised. One of the most heartening things in the report, after the news that there has been a substantial profit

(*continued on page 42*)

Notes and Comments

Stainless Steel Prospects

REPEATED references to the fact that finding markets has in some quarters replaced the earlier problem of making available sufficient materials to supply them are obscuring the recognition that there are still grave material shortages, some of which still hamper full operation of the most remunerative kind. A passage in the recent review by the A.P.V. Company's chairman was a timely reminder. "It is a strange anomaly," said Mr. P. W. Seligman, "that while so much of our energy has been devoted to furthering this country's export trade we have to face the threat of competition in our home market from imported reproductions of some of our own specialities—made from raw materials exported from this country, of which we find it difficult to secure adequate supplies". It can be confidently assumed that the nigger in this particular woodpile is chromium steel, of which the polished sheet is one of the categories hardest to get. This shortage, which in the case of these process plant manufacturers was principally felt in 1949, is being relieved, but the elaborate productive plant is not to be conjured up at short notice. Plants are in fact now being erected, one for Firth-Vickers Stainless Steels, Ltd., may be ready by the middle of next year; but no substantial help for those who need these corrosion-resistant steels for export production seems to be at hand.

Progressive Alcohol Industry

THE great growth of the British solvents industry has rather unaccountably received much less attention than its remarkable technical and commercial aspects have merited. The magnitude of recent expansion and the virtual certainty that the process will be continued was made clear at Hull on Tuesday by British Industrial Solvents, Ltd., then celebrating the completion of 21 years' fruitful work in organic chemical industry. During the years since the war, expansion of plant capacity on this almost unlimited site by the River Humber or improvement of processes to secure economies or adapt them to changing needs for solvents, plasticisers and intermediates have virtually been continuous. The current evidences of this policy are large increases now being made to the acetic acid, acetic anhydride and the 2-ethyl hexyl alcohol sections.

Adaptability

SEVERAL reliable factors lend weight to the view that the manufacture of solvents, plasticisers and intermediates as carried on at Salt End, near Hull, will be more or less independent of the uncertainties to which most other chemical industries are subject. Demand, at home or by the new industries overseas, is assured whatever pattern the expanding plastics, lacquer and other user industries may assume. The flexibility of the great distillation and kindred units—practically all operating as continuous processes and requiring the minimum of supervision—would permit the bulk of the production to be changed over to other alcohol forms in a matter of hours. Finally, the possibility of adverse conditions in the procurement of raw material, an ever present possibility in several other branches of chemical industry, is absent here. The molasses route by which the parent Distillers Company produces the ethyl alcohol, the basis of much of the production at Salt End and the other B.I.S. plants, is not the only source. The Grangemouth installation of the related British Petroleum Chemicals will start next year to produce ethyl alcohol and isopropyl alcohol, both basic materials for the Hull industry.

Coal to Cortisone?

OF the discovery of new by-products of coal—complementary to the large number already known—there appears to be no end. Many of these

have, in the past, been the products of tar from the two high temperature carbonisation systems, and are well known. The low temperature carbonisation of coal, however, results in the production of liquids and solids of entirely different compositions, about which very much less is generally known. In this provocatively undefined sphere, new products are always liable to materialise. The latest of these may almost be termed "spectacular." It is referred to in the statement by Commander Colin Buist, chairman of Coalite and Chemical Products, Ltd., circulated in advance of the company's meeting, to be held in London on July 21. At the low temperatures at which the Coalite process operates, he says, little cracking takes place, and there is produced a series of somewhat unstable materials of which very little was known prior to 1933. Even more significant is his claim that there is still no textbook which will give guidance on the working up of these materials on a commercial scale. Commander Buist was probably not overstating the comparative neglect of this field in claiming that the only real knowledge of the by-products released from coal carbonised at low temperatures was locked within the archives of the Coalite Company. That obliged them to carry out their own research with very little outside help from consultants and laboratories. The latest of the company's new products was found, not as a result of careful research work—as was generally the case—but by pure chance. That was 2-methyl resorcinol, isolated last year, which in the Dyson Perrins Laboratory at Oxford, was now being used as the starting point for a projected total synthesis of cortisone, the new drug for the alleviation of rheumatoid arthritis. If this somewhat unconventional line of approach succeeded the price of the material for alleviating rheumatoid arthritis might well fall to an economic level. The present long and involved series of reactions, requiring some 35 stages, to make Cortisone from natural products such as bile acids or plant sapogenins renders the drug prohibitively costly.

COAL AND THE CHEMIST

(*continued from page 40*)

instead of a loss, is the assurance that the drive for cleaner coal will be continued and intensified.

Even if a large proportion of the cleaning plant taken over from the private colliery industry was in fact old and inefficient, the increased use of machinery at the coal face, producing more dirt than hand working, has contributed largely to the serious fall in coal quality. Thinner and dirtier seams are also mentioned among the causes. If there is any evidence other than the judgment of mining engineers to prove that dirty coal is an inevitable condition it should have been presented in this report instead of some vague generalisations.

There is no doubt that science is today being more actively applied in the coal industry than ever before. The arguments of those who supported coal nationalisation on this score alone are beginning to be substantiated. But as the board is a public body and the industry is everybody's business, much more should have been made known of the research which the board sponsors. To be complete, this annual review should take some account of the research on coal which the board does not sponsor.

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Lead Price Again Reduced

The price of U.K. lead was reduced by £4 a ton from £92 to £88 on Thursday, June 29. This was the second reduction within a week, the previous cut being on June 24 to £92 from £96, the price which had been in force since May 12. Lead has now practically reverted to its pre-devaluation level of £87 5s.

DEFINING CHEMICAL INDUSTRIES

Rulings by Fourteen Countries at Geneva

IMPORTANT discussions affecting the chemical industry were held at the second session of the Chemical Industries Committee of the International Labour Organisation held in Geneva in April. Notes on the proceedings, which were divided under three main heads—general report, safety and hygiene in the chemical industries, and special aspects of working hours—have now been issued by the International Labour Office.

Of the 15 member states of the ILO of which the Chemical Industries Committee is composed, only China was not represented. Tripartite delegations were sent by the remaining 14 countries, namely, Belgium, Brazil, Canada, Denmark, France, India, Italy, Mexico, Netherlands, Norway, Sweden, Switzerland, the United Kingdom and United States. A delegation of observers from the German Federal Republic also attended.

Officers elected from the 78 delegates and 23 technical advisers were divided into three groups, representing Government, employers and workers.

Working Basis

The first problem was a discussion on the establishment of a permanent definition of the chemical industries. It was agreed to accept as a basis for its work the broad definition adopted by the committee at its first session which divided chemicals into three main groups: basic (or heavy), intermediary (industrial or semi-finished), and fine (or finished).

It was also understood that in every case in which it was not clear whether an industry or branch of industry was devoted entirely or mainly to the manufacture of chemical products, it would be for the competent national authority (after consultation with the employers' and workers' organisations), to decide whether that industry or branch of industry should in its country be classified in the category of chemical industries within the scope of the Chemical Industries Committee.

The United Kingdom Employers' member proposed that this freedom of choice should be reserved to the competent national authorities also in cases where labour relations in industries manufacturing chemical products were organised independently of those in the chemical industry, and he proposed the following modification: "It would be for the competent national authorities, in agreement with the employers' and workers' organisations concerned, to decide whether that industry or branch of industry shall in its country be classified in the category of chemical industries within the scope of the Chemical Industries Committee of the International Labour Organisation." This proposal was accepted by the Working Party without opposition.

New Nomenclature

The Working Party reaffirmed the view that it is the manufacture and not the use of chemical products which should serve as a basis for the definition of chemical industries. The Working Party, further, considered it desirable to establish, on the basis of the nomenclature of chemical products contained in the provisional definition, a new nomenclature as complete as possible.

It was, accordingly, decided to adopt as criteria: (a) the technological character of the operation; (b) the nature of the work and the system of wages used; (c) the commercial presentation of the final product; and to review in the light of these criteria: the products contained in the provisional list of chemical products adopted at the first session; the products whose inclusion in the list had been postponed at the first session; and certain additional products.

Debatable Items

Certain products gave rise to discussion and necessitated recourse to a vote for the purpose of deciding whether or not they should be retained in the new nomenclature.

Among these were the following: The inclusion of matches was opposed by some employers' members. Sweden and Denmark stated that only a very small proportion of workers in this industry were engaged in the chemical side of the production. The U.K. representative opposed it because the structure of industrial relations in this country was different in the case of the match industry from that of the chemical industry. Inclusion was decided on by a majority vote.

The item, industrial alcohol, was objected to as being unduly vague, but

after discussion was retained as originally worded.

Under the heading chemical products used for pharmaceutical purposes it was proposed by the British Government member, supported by the U.S. Workers' member to add: chemical products for veterinary purposes. This was unanimously adopted.

The discussion on the item radioactive products was concerned whether to add the words rare earths and their derivatives. On the proposal of the U.S. Government member it was agreed that the wording should be radioactive materials and products.

With regard to artificial and organic fibres after lengthy consideration it was decided that the manufacturing of synthetic organic fibres, but only up to and including their final preparation for weaving or knitting, is a chemical process.

Problem of Rubber

The item synthetic rubber also gave rise to discussion, on the question not of the inclusion of synthetic rubber, which was not contested, but on the inclusion of natural rubber. The United States Workers' member stated that synthetic rubber was being used more and more in his country, and that the processing of natural rubber was a chemical operation. The United States Government member proposed that this item be worded natural and synthetic rubber, excluding fabricated articles. This was agreed to.

Of the other products whose inclusion in the nomenclature had been postponed by the committee at its first session, the Netherlands Workers' member proposed to include the item glass industry, and he proposed the establishment of a subcommittee to deal with this industry. The proposal to include this item was not accepted, five members voting for this proposal and five against it.

The following resolution was adopted:—

That the following be considered as chemical industries within the scope of the Chemical Industries Committee of the International Labour Organisation, irrespective of existing classifications for strictly national purposes.

(a) Industries entirely or mainly devoted to the manufacture of the chemical products specified below.

(b) All branches of industry, to the extent that they are entirely or mainly devoted to the manufacture of chemical products as specified below, even in cases where the industries of which they are branches are not themselves entirely or mainly devoted to the manufacture of such products.

In every case in which it is not clear whether an industry or branch of industry is devoted entirely or mainly to the manufacture of chemical products, or where the labour relations in any of the industries manufacturing the chemical products specified below are organised independently from the chemical industry, it would be for the competent national authority, in agreement with the employers' and workers' organisations concerned, to decide whether that industry or branch of industry shall in its country be classified in the category of chemical industries within the scope of the Chemical Industries Committee of the International Labour Organisation.

For the purposes of the resolution, the expression chemical products denotes the following products:—

Acids, alkalis, oxides and salts.
Chlorine and its derivatives.
Sulphur, phosphorus, arsenic, antimony, iodine, bromine, fluorine and their compounds.
Chemical derivatives of aluminium.
Hydrogen peroxide, persalts and organic and inorganic peroxides.
Cyanides including derivatives.
Calcium carbide.
Nitrogenous compounds.
Artificial fertilisers, inorganic or organic.
Petroleum chemical products.
Chemical products or natural gas.
Products of the distillation of coal tar.
Products of the hydrogenation of coal, lignite or coal tar.
Explosives.
Matches.
Compressed, liquefied and dissolved gases.
Activated carbon and electro-chemical carbon, including artificial graphite.
Synthetic precious stones.
Soap, candles and glycerine, fatty acids and their derivatives.
Industrial alcohol.
Products of the distillation of wood.
Products of the hydrolysis of wood and lignines.
Dyeing and tanning extracts.
Resins; turpentine and camphor.
Adhesives.
Glue and gelatine.
Synthetic organic chemical products.
Chemical products used for pharmaceutical and veterinary purposes.
Sensitised and chemical products used for photographic purposes.
Perfumes and other aromatic substances, including natural and synthetic essential oils.
Organic and inorganic dyestuffs.
Lacquers, varnishes, paints, colours, pigments and inks.
Chemical products for cleaning and polishing.
Radioactive materials and products.
Synthetic resins and plastics, excluding fabricated articles.
Bituminous emulsions.
Corundum, carborundum and similar abrasives.
Insecticides and fungicides, dips and disinfectants, weed-killers and plant hormones.
Ancillary products for textiles, synthetic detergents and emulsifying agents.
Natural and synthetic rubber, excluding fabricated articles.
Chemical products obtained by fermentation.
Blacks, acetylene black, anthracene black, lamp-black, animal black and bone black.
Silicon tetrachloride, precipitated silica, silicic ethers and silicones.
Starches and modified starch.

FUNGICIDES FOR PACKAGE PROTECTION

Effective Compounds Now in Use

MOULD spores are in the air as a component of dust and may be present in water, on utensils and on the human skin. In favourable conditions of temperature and humidity—the optimum conditions are generally rated as 68° F.-104° F. and relative humidity 80-95 per cent—spore growth begins, at rates dependent on the species, chemical condition of surroundings and the food supply.

Many well packaged goods suffer from mould growth when stored under tropical conditions and a good deal of thought has been given by manufacturers to various non-toxic fungicides which can be conveniently incorporated in the packaging medium to increase their resistance to attack.

Ordinary cellulosic materials, such as paper in all its various forms and fabrics are subject to attack and ultimate destruction by moulds. Some microcrystalline wax compositions used for impregnating paper provide a good medium for growth and even pure paraffin wax is not entirely suitable as a protective agent. Cellulose acetate is more resistant to attack by moulds than ordinary regenerated cellulose: vinyl resin films, polythene and rubber hydrochloride all give a high degree of protection. It is, however, true that under the most favourable conditions of growth some species of fungi manage to grow on almost all surfaces.

Making a Choice

Choice of a suitable fungicide for treating packages is governed by several factors, of which the most important are these:—

1. Toxicity of the chemical at the recommended concentration, *e.g.*, phenyl mercuric compounds, although extremely poisonous and also irritant to the skin, are reasonably safe at concentrations of 0.00175 per cent and can be effectively used at this strength for treating textiles and some wrapping papers. A particularly harmless fungicide is calcium propionate which has been used with some success to treat butter and cheese wrappers to inhibit mould growth.[1]
2. Fungicides suitable for treating package material by adding to the paper stock in the beater or spraying on the packed goods must possess no dermatitic action. Here again a great deal depends on the concentration of the chemical. Pentachlorophenol, for example, is liable to cause skin irritation at concentrations of 0.5 per cent, but is apparently harmless at 0.25 per cent, the strength recommended for adding to the paper stock in the beater.[2]
3. Odour is of great importance and for many products, particularly food and cosmetics, a strong smelling substance liable to taint sensitive creams, lotions, fats, shortenings, etc., cannot be used. For this reason such chemicals as menthol and thymol are not generally satisfactory.
4. Non-volatility or very low volatility is usually an essential characteristic of a good fungicide. Most successful mould inhibitors, such as salicylanilide, are completely non-volatile, but there are others, such as biphenyl and o-phenyl which are sufficiently volatile to emit traces of vapour possessing pronounced fungicidal properties. Fungicides which depend upon the vapours they emit for their protective action have proved specially useful for treating fruit wrappers.[3]

Treating Paper

There are probably a dozen or so commercial fungicides which have found application in the packaging of products for export and some, such as phenyl mercuric compounds, can be used in very low concentrations for incorporating in synthetic waxes. Others, particularly para-nitrophenol, para - chloro - meta - xylenol, trichloro-phenol and pentachlorophenol find general application for treating paper and fibre-board. The last chemical in the form of soluble sodium pentachlorophenate is used by the paper manufacturer, who precipitates the insoluble pentachlorophenol on the paper by adding alum.

Calcium propionate and also sodium diacetate have been recommended as fungicides for incorporating in the product itself; the propionate has been employed as a constituent of bread to inhibit mould growth.

For use as constituents of films, such as rubber hydrochloride and certain vinyl copolymers, there are a number of powerful fungicides, such as o-hydroxybiphenol or chlorobenzoic acid, o-chlorophenol, biphenyl and o-phenyl phenol. Very small quantities of these chemicals, less than

(*continued at foot of next page*)

Industrial Pump Pioneers

Reading Firm's Celebrations

IN 1875, a small works in Battersea (London), with 30 employees, started the manufacture of a new type of steam pump, the Pulsometer. To-day, the Pulsometer Engineering Co., Ltd., with large works at Reading (Berks.), nearly 1000 employees and branches in the large industrial towns of England, Scotland, Northern Ireland and Wales, besides world-scattered agencies, makes virtually every conceivable type of industrial pump, turbine, rotary and vacuum. This three-quarters of a century of industrial progress is being celebrated by the firm in a special sports day to-day (July 8), when for three hours from 9.30 a.m. the works are being thrown open to all employees and friends.

40 per cent Exported

The firm soon ventured in several directions to satisfy industrial needs, and the success of its undertakings has led to the creation of various pumping, refrigeration and water purification departments. Its manufactures to-day comprise some seven hundred different types and sizes of pumps for all duties. It exports to all corners of the globe about 40 per cent of its annual total output, which in 1949 amounted to over 19,500 pumps. Pumps are supplied for numerous uses to every type of industry, including heating services, food and chemical processes, paper mills, sewage, and for lubrication, drainage, borehole pumping, etc.

Prominent among the specialised types is the Stereophagus pump, first made by Pulsometer, which revolutionised sewage pumping by the incorporation of a knife to cut up solids. Newer developments are the disintegrator, with eight knives, and the solids diverter. a Pulsometer patent, which is a self-clearing automatic enclosed-tank plant for dealing with sewage in large buildings or small communities to dispense with the need of heavy and expensive installations. Most recent and highly specialised are the new high temperature oil refinery pumps, which are stated to have been supplied to all new refineries throughout the British Empire.

The firm's vacuum pumps are of particular interest. Fifty years ago no practical mechanical high-vacuum pump existed, although certain low-vacuum mercury types were in use in laboratories. Pulsometer experiments developed the Geryk air pump which gave results far beyond anything hitherto attained. This is claimed to have since made X-ray tubes, wireless valves and incandescent lamps workable propositions, and Geryk high vacuum pumps are stated to-day to work in almost every lamp and radio factory in Britain. They are also being used in delicate surgical operations, for blood transfusions, and in innumerable laboratory and factory processes.

The company's enterprise in advancing industrial and domestic techniques has been characterised by many progressive ideas since water purification plant was first produced in 1878. Its modern self-cleaning filter design has been reproduced in the U.S.A. and most other industrial countries.

Chemical Society's Library

The library of the Chemical Society will be open from 10 a.m. to 5 p.m. daily, from July 17 to September 30 inclusive, except during the fortnight August 7 to 19 inclusive, when it will be closed entirely for revision and cleaning.

FUNGICIDES FOR PACKAGE PROTECTION

(*continued from previous page*)

0.25 per cent, are effective as mould inhibitors.

Before using any fungicide for treating packages for foods, cosmetics and pharmaceutical products it is necessary to carry out the most thorough tests to ensure that the fungicide is safe to employ at any specific concentration. In this country and also in North America a great deal of attention has been given to the subject of mould growth and its control in packaging. The subject has attracted an exceptionally large number of investigators, including such names as Glabe, Hajo, A. J. Hall, T. F. Heynes, H. S. Holden, W. F. Horner, F. R. Koppa, H. W. Herbst, C. G. Lavers and W. I. Illman.

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N-F METALS PRODUCTION AND STOCKS

Some Notable Increases in May

MOST Government and consumers' stocks of the principal non-ferrous metals at the end of May showed notable increases over the corresponding month last year. Among the increases (the 1949 figure shown in brackets) were:—Blister copper 43,083 tons (38,209); refined copper 81,208 (79,282); zinc in concentrates 32,855 (10,655); lead in concentrates 90 (48); imported virgin lead 60,169 (43,160); English refined lead 5154 (3500). The figure for slab zinc in all grades was down at 49,841 tons (60,741); stocks of tin metal were also slightly smaller at 14,401 tons compared with 14,843 tons in May, 1949.

Production of most kinds also showed increases, output of slab zinc being 5417 tons (4986); lead in concentrates 265 (191); English refined lead 6290 (2325); alloyed copper products 26,101 tons (22,862); copper sulphate 5003 (4093).

Production decreases were: blister copper 1526 tons (3388); refined copper 13,351 (15,389); unalloyed copper products 24,875 (25,938).

UNWROUGHT ZINC

Long Tons

	Zinc in Concentrates (estimated gross Zinc content)	Slab Zinc (all grades)
OPENING STOCKS:		
Govt. and consumers'	35,551	46,594
Imports	3,940	17,851
PRODUCTION:		
Virgin and remelted	—	5,417
CONSUMPTION:		
Virgin (incl. debased)	6,636	20,061
Remelted and scrap	—	7,180*
Exports and re-export	—	7
CLOSING STOCKS:		
Govt. and consumers'	32,855	49,841

* Includes small quantity of zinc in concentrates consumed directly for chemicals, etc., which is also included as consumption of concentrates.

LEAD

Long Tons

	Lead in Concentrates	Imported Virgin Lead	English Refined	Lead Content of secondary Scrap and Residues
OPENING STOCKS:				
Govt. and consumers'	—	56,416	5,061	—
Other stocks	78	—	—	—
IMPORTS	—	17,081	—	300
PRODUCTION	265	—	6,290	—
CONSUMPTION	253	14,084	6,197	7,990
EXPORTS		135	—	—
CLOSING STOCKS:				
Govt. and consumers'	—	60,169	5,154	—
Other stocks	90	—	—	—

UNWROUGHT COPPER

Long Tons

	Blister Copper	Refined Copper
OPENING STOCKS:		
Govt. and consumers'	46,815	81,089
Imports	4,508	21,444
PRODUCTION:		
Primary	—	7,730
Secondary	1,526*	5,621
CONSUMPTION:		
Primary	7,794	27,709
Secondary	—	15,700
Exports	3,304†	55
CLOSING STOCKS:		
Govt. and consumers'	43,083	81,208

* Rough Copper.

† Includes 2400 tons of rough copper despatched to Belgium and 904 tons of rough copper to Germany for refining on toll.

GROSS OUTPUT OF MAIN COPPER, ALLOY AND PRODUCTS

Unalloyed copper products	24,875 long tons
Alloyed copper products	26,101 ,, ,,
Copper sulphate	5,003 ,, ,,

TIN METAL

Long Tons

GOVT. AND CONSUMERS' STOCKS (at end of period)	14,401
IMPORTS	90
PRODUCTION	—
CONSUMPTION	2,101
EXPORTS AND RE-EXPORTS	2,032

ANTIMONY

Long Tons

TOTAL CONSUMPTION OF ANTIMONY METAL AND COMPOUNDS	431
TOTAL CONSUMPTION OF ANTIMONY IN SCRAP	324

CADMIUM

Long Tons

TOTAL CONSUMPTION OF CADMIUM	49.25

Key Industry Duty

A TREASURY Order has been made continuing the exemption from Key Industry Duty until December 31, 1950, of all articles previously exempted until June 30, 1950, with the following amendments:

Additions: Amyl acetate, cyclohexanone, cyclohexylamine, di-cyclohexyl phthalate, 2-diethylaminoethyl, diphenylacetate hydrochloride, *s*-dimethyl urea, guanine, quinoline, 2,4,5-trichlorophenol.

Deletions: Anisaldehyde, chloroiodohydroxyquinoline, *mono*chloroacetic acid, *o*-chloronitrobenzene, *mono*ethylamine, ethyl*iso*amylbarbituric acid, ethyl sulphate, pentachlorophenol, propiophenone, sodium ethyl*iso*amylbarbiturate, sodium ethyl *a*-methylbutyl barbiturate, sodium *a*-methylbutyl allylbarbiturate, succinic acid (but not including *iso*succinic acid), integrators (planimeter type).

C

DETERGENTS FROM SHALE OIL

*Synthesis from Scottish Raw Material**

SOMETHING of the chemistry of the lighter fractions of Scottish shale oil is known and many individual hydrocarbons have been identified, but there is not much information on the nature of the kerosine and gas-oil fractions of interest for the purpose under review.

Shale oil differs from petroleum in a number of important points, but of most interest in the present instance is that Scottish shale oil contains appreciable proportions of unsaturated hydrocarbons.

Some work at the Sunbury Research Station of the Anglo-Iranian Oil Company indicated that a kerosine/gas oil fraction, of boiling range 199° to 309° C. and sp. gr. 0.834, had the following constitution:[1]

	Per cent by wt.	
Paraffins	31	
Naphthenes	11	
Aromatics	16	
Mono-olefines	26	alkenes and cyclenes.
Di-olefines	16	

In planning the production of synthetic detergents from Scottish shale-oil distillates, three courses were open:—

1. Physical or chemical methods to separate olefines or paraffins, the separated hydrocarbons being used directly in the manufacture of detergents. Thus the olefines could be converted into secondary alkyl sulphates by treatment with sulphuric acid, or the appropriate paraffins might be used for the production of alkyl sulphonates via the Mersol or Hostapon processes, which were developed for use with the Fischer-Tropsch paraffins in Germany just before the second world war.

2. High-molecular-weight waxes thermally cracked to give straight-chain, liquid olefines for direct sulphation to secondary alkyl sulphates.

3. Appropriate cracking conditions employed to produce mainly gaseous olefines which could be used in the manufacture of non-ionic detergents.

The direct utilisation of olefinic constituents of shale oil appeared the most suitable route to synthetic detergents, in view of the high cost of shale oil and particularly as the unwanted portions accompanying the olefines could be returned to process, unaffected. This process also involved readily available equipment and methods traditional in the shale-oil industry, whereas physical separation of paraffins in the range necessary for use in the production of alkyl sulphonates presented considerable difficulty.

Preliminary laboratory work indicated that shale-oil alkyl sulphates had notable wetting and detergent properties, and so an oil in the kerosine/gas-oil range was divided into a series of fractions of ascending boiling range, and each of these fractions was sulphated direct with acid. As a result, it was shown that certain cuts gave superior wetting agents and detergents. It also showed that as the homologous series was ascended from C_{10} to C_{20} the water solubility of the alkyl sulphates decreased until they became practically insoluble.

A shale-oil cut was thus chosen which, on sulphation, would give the maximum yield of best-quality product, readily soluble in water and not liable to freeze out or gel during low temperature storage.

Olefines as Feedstock

At the same time fundamental work was carried out at Sunbury, using pure olefines as feedstock. This confirmed that the lower alkyl sulphates, such as dodecyl sulphate, were much more soluble in water than the higher homologues such as octadecyl sulphate. The work also indicated the optimum quantity of sulphation acid required for best results and showed that in sulphation, time of contact of hydrocarbon with acid was an important factor as regards yields, because the sulphation reaction was reversible in the presence of acid.

It was also found that in the sulphation of pure olefines, di-alkyl sulphates were formed as well as mono-alkyl sulphates and that the relative proportions of these depended on the ratio of acid to olefine and time of contact. An increase in the ratio of acid to olefine and reduction of time of contact favoured the production of mono-alkyl sulphates. Di-alkyl sulphates have no detergent properties, but the di-sulphate can be readily hydrolysed

1 Haresnape, D., and Lowry, R. A. "Chemical composition of Scottish shale oil distillates," Oil Shale and Cannel Coal Conference, 1950.

* Abstracted from a paper by D. Stewart and E. McNeill, which was read at the second Oil Shale and Cannel Coal Conference, held at the Royal Technical College, Glasgow, from July 3 to July 7. The authors acknowledge the collaboration of colleagues at Scottish Oils Ltd., and the Anglo-Iranian Oil Co., Ltd., and the companies' permission to publish the paper.

to the corresponding mono-sulphate, by boiling with alcoholic potash under reflux. This can be carried out more slowly in an aqueous solution of alkali.

This work with pure olefines suggested the best conditions for adoption in the sulphation of shale-oil olefines, and corroborated much previous work in this direction.

Following further laboratory work in Scotland and at Sunbury, a pilot plant was erected at Pumpherston shale-oil refinery. This plant had a feedstock capacity of 15 gal. per batch and was intended for the investigation of process variables, to provide data for the erection of a commercial plant, and to train a nucleus of personnel in the operation of the specialised equipment required. Over 150 batches of detergent were prepared in this plant, and latterly it was used to prepare samples for appraisal until the larger plant was in operation.

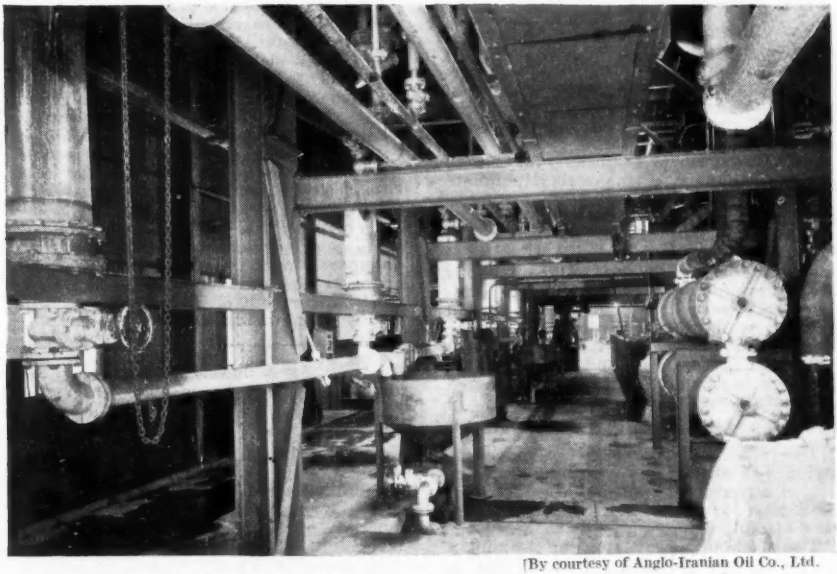
From the experience gained with the pilot plant, a commercial plant was designed, and was in course of erection even while the pilot plant was still at work on some of the finer points of the process. While the pilot plant was run batchwise, many of the steps were converted to continuous operation in the larger unit.

At starting up, some initial difficulties were experienced, particularly in running the sulphation step continuously instead of batchwise as in the small-scale work, but despite this the first batch was pumped to stock in April, 1948.

In this plant the process is as follows:—

A shale-oil distillate is drawn as a side stream from the fractionating column of the distillation unit charging crude shale oil. This distillate has a boiling range of approximately 180° to 330° C. and contains small but significant proportions of both nitrogenous bases and of tar acids or phenols. These are removed by washing first with diluted sulphuric acid and then with caustic soda. The treated oil stock is then re-distilled in a smaller pipe-still unit to give the hydrocarbon feedstock, which is then passed to the detergent plant for conversion of the unsaturated constituents into water-soluble alkyl sulphates.

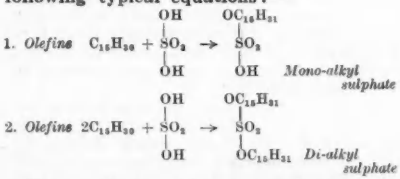
This feedstock is contacted with 96 to 98 per cent sulphuric acid, while the temperature is maintained at 10° to 20° C. by passing the acid-treated oil through brine-cooled chillers. The main reaction is that unsaturated components of the oil combine directly with the acid to form both mono- and di-alkyl sulphates according to the



[By courtesy of Anglo-Iranian Oil Co., Ltd.

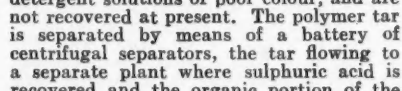
A ground floor view of the detergent plant at Pumpherston, showing lower part of neutralisers (left) and sulphation coolers (right)

following typical equations:—



These alkyl sulphates remain for the most part dissolved in the oil, but a polymer tar is also formed which contains some sulphates in solution. These produce detergent solutions of poor colour, and are not recovered at present. The polymer tar is separated by means of a battery of centrifugal separators, the tar flowing to a separate plant where sulphuric acid is recovered and the organic portion of the tar prepared for use as liquid fuel.

The "sulphated oil" running into the separators is neutralised by a solution of sodium carbonate in one or more neutralisers. The sodium salts of mono-alkyl sulphates are formed with liberation of carbon dioxide:—



These sodium alkyl sulphates immediately emulsify the unreacted oil to a cream-coloured emulsion. When the requisite quantity of sulphated oil has been run into each neutraliser the temperature is raised to 90° C. by steam-coils, and stirring continued.

Maintaining these conditions for five to six hr., the yield of mono-alkyl sulphate is increased, due to the hydrolysis of di-alkyl sulphates.

Once hydrolysis is complete, the batch is cooled and weak *iso*propanol is added to break the emulsion and to dissolve out sodium alkyl sulphates. Two layers form, the upper consisting of unreacted oil and alcohol, while the lower is an alcoholic solution of sodium alkyl sulphates with unreacted mineral oil and excess alkali. The two layers are run down and stored in separate receivers.

Alcoholic Oil Layer

The alcoholic, unreacted oil layer is stripped of alcohol in a continuous, steam-heated stripper, the alcohol vapour being condensed for re-use, and the oil returned to the refinery for processing to diesel oil.

The alcoholic detergent layer contains a proportion of mineral oil, and this is removed by counter-current washing with a special-boiling-point solvent spirit.

The washed alcoholic detergent solution contains solvent spirit in place of oil, and both alcohol and solvent spirit are removed and the detergent concentrated by continuous evaporation in a set of three steam-heated evaporators arranged in cascade.

These evaporators control the frothing which occurs in boiling this type of detergent solution. The alcohol and solvent-spirit vapours passing overhead from the evaporators are condensed, and the components separated and run to storage tanks for re-use.

The concentrated detergent solution, free from alcohol and solvent spirit, leaves the evaporators as a syrupy liquid.

The offtake from the evaporators is blended in batches to the required concentration, and the *p*H value is adjusted to 7.5—8.5 by the addition of dilute sulphuric acid. Finally, the batch is filtered through a pressure filter before passing to storage, a filter aid being added in small proportion to the steam as it enters the filter.

The filtered product is conveyed through ebonite-lined steel pipes, but more recently either stainless steel or Monel piping has been used.

The storage tanks at first erected were of steel lined with Polythene, sprayed on by the Schori powder process. New tanks now in use are constructed of stainless-clad-steel plates. From the storage tanks, the finished detergent is pumped to the filling points via displacement meters constructed of stainless steel throughout. Despatch is either in 20-oz. domestic bottles, 1-gal. stone jars, or wooden barrels of from 5 to 40 gal. capacity. Quantities are also dispatched by road car, normally of aluminium or stainless steel.

Chemically, this detergent is an aqueous solution of organic active agents, predominantly of the alkyl sulphate type. In addition, the product contains not more than 5.5 per cent of inorganic salts, principally sodium sulphate.

Swiss Chemical Exports

An increase is reported in Swiss exports of chemical and pharmaceutical products from Swiss Fr. 35.9 million in April to Fr. 42.2 million in May. The most marked increase, from Fr. 13.2 million to Fr. 17.9 million, occurred in exports of dyestuffs and the next largest was in pharmaceutical products, with Fr. 16.8 million (15.8 million). Industrial chemicals rose by Fr. 1 million to Fr. 6.2 million, but exports of perfumery declined from Fr. 1.7 million to Fr. 1.5 million.

THE FULLER USE OF COAL TAR

Re-assessment of Potentialities Necessary

by M. KAUFMAN, B.Sc., A.R.I.C.

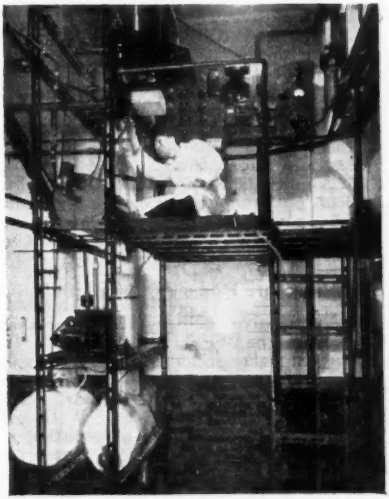
IT is in the nature of a paradox that coal tar, so often referred to as "the treasure house of organic chemicals," is treated as something of a stepchild in the family of coal and coal products. In spite of the indispensable substances it yields, it still retains the status of a by-product rather than a raw material in its own right. Yet it is one of the few indigenous raw materials we possess and is available in quantities of over two million tons a year.

These reflections are occasioned by the problems that are currently facing the tar industry and by the urgent need to use our national resources to the full.

Tar is one of the volatile constituents obtained, with gas and ammoniacal liquor, in the carbonisation of coal. It accounts for about 5 per cent by weight of the charge but varies considerably in yield and character, depending on the purposes for which the coal has been treated. About 60 per cent of the total production derives from gas making while over 30 per cent comes from coke ovens.

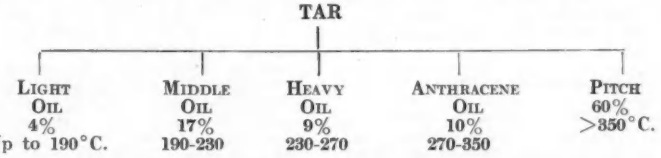
In normal distillation tar is resolved into a number of fractions as shown in the diagram. This indicates the approximate yields of the various cuts but they are not intended to be precise. Temperature ranges indicated are not strictly adhered to; they fluctuate in accordance with market requirements as well as with local practice. They depend, moreover, on the type of coal used and they vary in their relative proportions with the method of carbonisation. This last consideration is the most important from the point of view of the yields as well as of the character of the resultant tar.

Broadly speaking, for a given coal, the higher the temperature of carbonisation and the longer the time of exposure of the tar to this temperature, the more aromatic it will be and the greater its pitch content.



Still for isolation of high boiling constituents from anthracene oil

The quantity of acid and base constituents will also be affected. It is thus possible to predetermine to some degree the tar content. Of the three main types of retort in use, horizontal, vertical and coke oven, the last is most suitable for the subsequent extraction of chemicals.



An increasingly important and promising department is the so-called low temperature tars, those produced at 450-700°C. These differ very considerably from the other types in that they are more aliphatic in character and contain relatively large quantities of phenols. The tonnage made is very small as compared with the high temperature tars.

(*continued overleaf*)

Listing the individual substances obtained from tar, as worked at present, discloses that they are very few, in spite of the enormous variety of materials which are ultimately derived from them. The following are the most important:—

1. Benzene. An organic chemical which is the basis of many industrial syntheses.
2. Toluene. A solvent and constituent of the explosive TNT.
3. Xylene. A solvent used in paints and varnishes.
4. Naphtha. A solvent.
5. Pyridine. Used in pharmaceuticals and in the denaturing of alcohol.
6. Phenols and cresols. Constituents of the Bakelite type of plastics; basis for nylons and antiseptics.
7. Naphthalene.—Used in the production of phthalic anhydride for synthetic resins.
8. Anthracene. Used in "40 per cent paste" as basis for dyestuffs.

"Treasure House of Chemicals"

The first five of these substances all come from the "light oil" fraction (in addition to some scrubbed out of the gas) and, as the diagram indicates, they account for less than 4 per cent of the tar. The phenols and cresols make up less than 2 per cent, while 40,000 tons of naphthalene and 3000 tons of anthracene are extracted from a total annual production of about 2½ million tons. Overall then, about 7 per cent of the tar is used as a source of chemicals; not a very impressive figure for the "treasure house of chemicals."

The other 90 per cent, consisting of the creosote, anthracene oil and pitch, is used for such purposes as fuel, road surfacing, timber preserving and so on. All, broadly speaking, are materials of low economic value. It is this part of the tar, however, which provides the bulk of the revenue of the industry and these are the products which are most exposed to the competition of the rapidly expanding petroleum refining projects in this country.

Increasing Competition

The scale of the growth of the competing industry can be gauged from the fact that by 1953 plant with a capacity of 19 million tons of finished product will have been erected, as compared with the present throughput of about 8 million tons a year.

The petroleum industry is competitive with tar throughout almost the whole field of application. Bitumen serves for road dressing, as does road tar, while heavy petroleum oils can and do compete with tar oils and pitch-creosote mixture as fuels. In the lighter fractions white spirit is comparable with naphtha.

The United States now prepare phthalic acid and anhydride by the oxidation of *o*-xylene, a petroleum product, as well as from naphthalene, and during the war toluene was prepared in large quantities by the catalytic dehydrogenation of methylcyclohexane.

A more direct threat to home markets in the purely chemical field comes from the operation of the Catarole process by Petrochemicals, Ltd. This is known to produce a range of chemicals from benzene, toluene, etc., to the higher polycyclic aromatic compounds. The extent to which these will be exploited remains to be seen, but the lower boiling aromatics are already on the market at competitive prices.

The main threat of petroleum, is, however, to the oils and pitch of tar, as well as road tar itself, and it is on these that attention will have to be concentrated.

A factor which cannot be ignored when assessing the prospects of the tar industry, is the likelihood of diminishing export markets. Our industry is being subject to increasing competition from abroad, more particularly from the revived German coal and chemical industries, and this will be bound to effect the outlets for tar and its products.

Other Uses

These increasingly competitive conditions invite a re-assessment of the possibilities and potentialities of coal tar. Is this raw material being exploited to the full, and if not, how can it be made to yield more? Are the technical methods used by the industry of the kind to ensure maximum extraction of the substances already obtained from tar? Is the chemical industry fully aware of the large range of materials available in tar and can it be stimulated to make fuller use of them?

The first of these questions finds a partial answer when attention is paid to the tar prior to distillation. For example, could not the blending of gas and coke oven tars be avoided, where the tar is a very good source of chemicals? Would it not be possible, within the limits laid down by gas and coke manufacture, to make some changes to secure optimum conditions for tar production?

It has to be admitted, however, that no great change can be anticipated in the character of the tar coming from the gas making or coke oven retorts. That does not necessarily imply that we must accept it as it stands. The great petroleum industry would never have reached its

present position if it had accepted such limitations. Flexibility is the great feature of petroleum refining, and its instrument has been the bold application of such chemical processes as cracking, isomerisation, cyclisation and so on. If tar has certain deficiencies as a raw material, why should we not have a shot at rearranging its molecules to suit our own requirements?

It is evident that the maximum potential even of tar as it comes now is not being realised. Over 50 per cent of tar is distilled in old fashioned inefficient pot stills. The full extraction of those substances worked up now is impossible, let alone the isolation of some of those present in smaller quantities.

The more widespread use of modern pipe stills would allow much higher yields, and therefore lower costs, of such products as naphthalene and anthracene, while closer fractionation on high efficiency fractionating columns would make it possible to isolate on a commercial scale such compounds as indene, the bases picoline, lutidine and collidine, dicyclopentadiene and a number of others.

The extension of this technique to the higher fractions of coal tar would no doubt be profitable. From a technical point of view the extraction of chemicals from these oils is quite feasible, for it is known that fractional distillation under reduced pressure can be extended to include constituents with boiling points in the region of 350°C.

Dr. Kruber, in Germany, has done much work in this field, which he has reported quite fully[1]. and has demonstrated that there is a whole range of chemicals which can be isolated without undue difficulty. Nor is he alone. Reilly Coal Tar Chemicals in the U.S. and Powell Duffryn Research Laboratories among others in this country have confirmed this.

Some chemical individuals which are thus made accessible in significant quantities are given, with their formulæ.

Fresh Outlets

Apart from these individual compounds, interesting and useful oils can be obtained which might be used for high boiling solvents, among other purposes.

From the chemist's point of view, the compounds listed form the starting point for the synthesis of materials used in various branches of industry. Acenaphthene, for example, can be used as a dyestuffs intermediate, it may be converted to acenaphthylene, which polymerises and copolymerises to give plastics of improved heat resistance or it can be oxidised to 1.8 naphthalic acid, which is analogous in

α methyl naphthalene 

β methyl naphthalene 

Acenaphthene 

Diphenylene oxide 

Fluorene 

Phenanthrene 

Carbazole 

Fluoranthene 

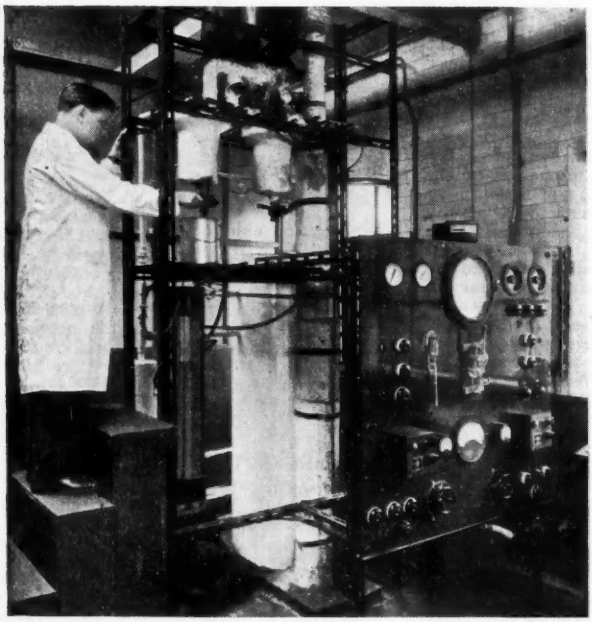
Pyrene 

Chrysene 

structure with the very valuable phthalic acid. Alpha methyl naphthalene may be converted to a plant hormone, while β methyl naphthalene can be used as a basis for the synthesis of the antihæmorrageic vitamin K. Carbazole dyestuffs such as Hydron Blue and the plastic known as Luvican indicate outlets for yet another member of this group of chemicals. Pyrene by oxidation readily yields the tetra carboxylic acid of naphthalene, a dyestuff intermediate.

One could continue to add to this list of possible applications, though it has to be noted that Dr. Kruber, as a result of his experience in trying to dispose of relatively small quantities of some of these chemicals, was disappointed by the smallness of the response he met.

This is perhaps a reflection on the slowness of the chemical industries to appreciate the potentialities, but it is reasonable to suppose that if large quantities were made available at moderate prices the challenge they would present to the ingenuity of the organic chemist would not go unanswered. This is precisely what the higher fractions



The head of a high efficiency fractional distillation unit

(Both photographs by courtesy of the Powell Duffryn Research Laboratories, London)

of coal tar offer, for if these substances are available only to the extent of 0.5-1 per cent of the tar they still represent a potential output of several thousand tons a year.

The fuller exploitation of tar, from the chemical point of view, would thus considerably upgrade its value. This approach, however, does not exhaust the possibilities of dealing with the present position. It may not even be the most important. The biggest part of the tar will continue to be absorbed by the "bulk" applications, and therefore research work will have to be directed to improving them.

It is certain that only the greater use of scientific and technical advances will enable the industry to cope with the problems which appear to lie ahead. Perhaps, in the long run, the threat of increased competition will be the spur to exploiting the full potential of one of our major national assets. The recent establishment of the Coal Tar Research Association appears to have brought that prospect appreciably nearer.

[1] Survey of New Materials in Coal Tar. *Angew. Chem.* 61. 59-63, 1949.

Defence Science Conference

THE promotion of scientific research in all branches of defence by closer collaboration within the Commonwealth is the object of a meeting of the Commonwealth Advisory Committee on Defence Science which opened in Cambridge this week and will continue until July 20. This is the first occasion that scientists have met under the new committee, on which are representatives from the United Kingdom, Canada, Australia, New Zealand, South Africa, India and Pakistan. Sir Henry Tizard is presiding.

Sillimanite for Ceramics

VISITORS to the ceramic engineering laboratory at Clemson College, South Carolina, are invited to fling cups and saucers against the concrete walls—and are surprised to find no breakages. The laboratory's ceramic experts have produced what they claim is an unbreakable and lightweight porcelain. It is composed chiefly of sillimanite, the mineral discovered about 12 years ago by a soil conservaton expert in South Carolina. So few deposits are known that these cups and saucers are not yet marketed.

ORGANIC SOLVENT MANUFACTURE

*Methods Recently Developed in Great Britain and the U.S.A.**

IN the field of petroleum solvents the technique of precise fractionation has been continuously developed, with the result that it is possible to obtain such products as cyclohexane, methyl cyclohexane and dimethylcyclopentane by direct fractionation. Benzene and toluene are produced by the catalytic dehydrogenation of cyclohexane and methylcyclohexane respectively, toluene being also produced by isomerisation of dimethylcyclopentane and purified by extractive distillation.

The most interesting field of solvent manufacture is the synthesis of various ketones and alcohols which were formerly derived from natural sources or fermentation processes. The base materials are the lower unsaturated and saturated hydrocarbons, with the more general use of the olefines ethylene, propylene and the butylenes, rather than the paraffins, which are not so reactive.

One of the chief sources of these gases is the waste gas from petroleum refineries where cracking is being carried out and where the considerable amount of gas produced includes hydrogen, methane and higher compounds. The gas stream may be separated into cuts by straight fractionation or by absorption and fractionation together.

Hypersorption

In this respect, the latest development is to absorb the lighter gases selectively on to activated charcoal and then strip them from the adsorbent. This process, called hypersorption, can give a recovery of 98 per cent ethylene, of 92 per cent purity, from a mixed stream of hydrogen, ethane, methane, propane, ethylene and propylene. In addition, some hydrocarbons can be incorporated straight into petrol, or by alkylation or isomerisation.

Another process for the manufacture of solvents is the direct oxidation of natural gas hydrocarbons, after suitable cuts have been achieved by compression, absorption and distillation. Rigid conditions of temperature and pressure, charge rate and gas-hydrocarbon ratios are essential, as also is the catalyst used. The crude product contains many things difficult to separate, formaldehyde, ethanol and methanol, acetic acid and acetone, and the propanols and butanols.

These products are separated by simple distillation with close fractionation, selective solvent extraction, evaporation, azeotropic distillation, adsorption and absorption, etc. In some cases oxidation of the isolated materials is employed to give products found only in small quantities in the primary step. The oxidation of propane, which is typical, gives *n*-propyl alcohol, propionic acid, propionaldehyde and acetone, among other things.

Advantages of Oxidation

The direct oxidation of paraffins is a delicate operation and final separation is difficult and costly; synthesis from the olefines is a much simpler process. The main advantage of the oxidation process in the U.S. is the cheapness and abundance of natural gas. In this country, however, there are no large natural gas reserves, neither are there large supplies of refinery gases, though the refineries scheduled to start production in 1952 should provide a considerable amount of gases for the synthesis from olefines.

Cracked gases contain a high percentage of ethylene in addition to propylene and butylenes. The ethylene may be separated by fractionation, but the distillation is inconvenient and refrigeration expensive. An interesting alternative method is developed by the Union Oil Co., in which hydrocarbons are selectively adsorbed on a moving bed of activated charcoal and then subsequently removed from the charcoal by heat treatment and steam stripping.

The control of the process depends on the principle that, because the heavier components are more readily adsorbed than the lighter, the temperature of the activated carbon bed is characteristic of the materials being adsorbed at any point. The take-off is regulated by a temperature controller operating on the sharp temperature break in the rectifying section caused by the gas adsorption.

The light gases are removed from the top of the rectifying section, while some of the gas is allowed to pass up through the cooling section down which the carbon stream is descending. The gas is removed from the top of the hypersorber and used as the

* A condensed abstract of the Royal Institute of Chemistry paper, " Modern Methods of Organic Solvent Manufacture," by Dr. J. L. Edgar, who acknowledges his debt to the Shell Chemical Corporation of America for permission to use previously unpublished data.

lift to carry the moving carbon bed back to the top again. A bleed stream is taken from the lift gas and used to control the fines formed in the carbon by attrition.

The process is capable of recovering very pure ethylene from a gaseous mixture containing hydrocarbons up to and including propane and propylene. In the presence of heavier components there is, however, the tendency for polymers to form on the surface of the carbon, poisoning and deactivating it.

Direct Hydration of Ethylene

Ethylene is converted into ethyl alcohol either by direct hydration or by reaction with sulphuric acid and subsequent hydrolysis of the alkyl esters. The direct hydration method consists of passing ethylene and steam in the vapour phase at high pressures over a catalyst. This method was first operated on a commercial scale by the Shell Chemical Corporation of America.

In a typical plant which uses the sulphuric acid method, ethylene is absorbed in a counter-current tower down which flows 97.5 per cent sulphuric acid at between 200 and 500 p.s.i., and at 80° C., the heat of reaction being absorbed by built-in cooling coils. The acid, which contains diethyl sulphate and ethyl hydrogen sulphate, is diluted with water and the esters hydrolysed.

The crude alcohol is stripped by steam, the acid leaving at about half strength, and the alcohol vapours are scrubbed with caustic soda, condensed, and distilled. The crude alcohol passes first to an ether column in which the by-product ethyl ether is removed from the top and then back washed with water to remove final traces of alcohol. The ether-free alcohol passes to a rectifying column where the finished alcohol is taken off overhead as an azeotrope containing 95 per cent by weight of alcohol. The chief disadvantage of this process is the necessity for re-concentration of the sulphuric acid used.

Ethyl Chloride

Ethyl chloride is made directly from ethylene by the action of anhydrous hydrogen chloride in the presence of a catalyst, crude ethyl chloride being being separated by distillation and purified by two-column distillation. The process requires corrosion-resistant equipment.

Ethylene oxide, another important derivative, is made by chlorhydrinating ethylene with hypochlorous acid at below 10°C. Ethylene chlorhydrin produced is hydrolysed with lime, which splits off HCl and gives ethylene oxide, which is purified by distillation.

$$CH_2 = CH_2 + HOCl \rightarrow$$
$$HOCH_2CH_2Cl \rightarrow \underset{\diagdown\ O\ \diagup}{CH_2 - CH_2} + HCl$$

Ethylene glycol is produced by treating ethylene oxide with water in the presence of sulphuric acid.

$$\underset{\diagdown\ O\ \diagup}{CH_2 - CH_2} + H_2O \rightarrow \underset{\substack{\mid \\ OH}}{CH_2} - \underset{\substack{\mid \\ OH}}{CH_2}$$

The glycol may be oxidised by passing it in the vapour phase over a copper catalyst at 250°C. in excess air. Glyoxal, a valuable intermediate, is formed.

$$\begin{array}{l}CH_2OH \\ \mid \\ CH_2OH\end{array} + O_2 \rightarrow \begin{array}{l}CHO \\ \mid \\ CHO\end{array} + 2H_2O$$

A new Shell plant soon to start operation at Stanlow will produce a wide range of solvents. The feedstock is gas oil and the working conditions allow the cracked residue to supply the fuel requirements of the entire plant.

Cracking

Cracking is carried out in the vapour phase at high temperature and low pressure, and the products are separated into two fractions. The light fraction, which has an end point of 190° C., is separated into fuel gas containing all the hydrogen, ethane, methane and ethylene; a highly pure C_3 cut, containing 92 per cent propylene; a high purity C_4 cut; a C_5 cut which is re-cycled; and an aromatic distillate containing high percentages of benzene and toluene.

The separation process consists of compressing the vapours from the cracking unit and then feeding these, together with the liquid, to an absorber stripper in which the heavier components are absorbed in a portion of aromatic distillate. The overhead gases are free of pentanes and, after removal of H_2S in diethanolamine solution, are compressed and dried. They are then fed to a fractionating system of an ethane column, a methane column and a propane column.

Propylene from the olefine synthesis method requires only a wash with caustic soda to remove mercaptans and traces of H_2S. But the C_4 stream contains butadiene and *iso*butylene, both of which must be removed prior to solvent manufacture.

Alcohols are synthesised by treating the olefines with sulphuric acid, hydrolysing the mono- and di-alkyl esters produced and stripping the crude alcohols from the dilute acid with steam. The water molecule entering the olefine molecule distributes itself so that the hydroxyl group

attaches to the carbon atom having the least number of hydrogen atoms attached to it. In this way only secondary and tertiary alcohols are produced. The acid reaction is slow and requires time tanks without heat, because the effect of temperature, which would increase the rate of reaction, also produces undesirable ethers and polymers. The strength of the acid used depends on economic considerations.

Distillation of the crude alcohols is complicated because *iso*propyl, secondary butyl and tertiary butyl alcohol all form minimum boiling point azeotropes with water. The anhydrous alcohols are obtained by distilling them with a water carrier which forms a low boiling ternary azeotrope; the water is thus carried overhead.

Ketones are produced from the alcohols by catalytic dehydrogenation in the vapour phase at high temperatures. *Iso*propyl alcohol on dehydrogenation gives acetone,

$$\begin{matrix}CH_3\\CH_3\end{matrix}\!\!>\!CHOH \rightarrow \begin{matrix}CH_3\\CH_3\end{matrix}\!\!>\!C=O + H_2$$

Secondary butyl alcohol yields methyl ethyl ketone,

$$\begin{matrix}CH_3CH_2\\CH_3\end{matrix}\!\!>\!CHOH \rightarrow \begin{matrix}CH_3CH_2\\CH_3\end{matrix}\!\!>\!C=O + H_2$$

From acetone, diacetone alcohol can be made by passing over a suitable catalyst at low temperatures,

$$\begin{matrix}CH_3\\CH_3\end{matrix}\!\!>\!C=O + O=C\!<\!\begin{matrix}CH_3\\CH_3\end{matrix} \rightarrow$$

$$CH_3-\overset{\overset{OH}{|}}{\underset{\underset{CH_3}{|}}{C}}-CH_2-\overset{\overset{O}{\|}}{C}-CH_3$$

Diacetone alcohol can be dehydrated with a suitable catalyst to give mesityl oxide,

$$CH_3-\overset{\overset{OH}{|}}{\underset{\underset{CH_3}{|}}{C}}-CH_2-\overset{\overset{O}{\|}}{C}-CH_3 \rightarrow$$

$$CH_3-\underset{\underset{CH_3}{|}}{C}=CH-\overset{\overset{O}{\|}}{C}-CH_3 + H_2O$$

A recent process started by the Shell Development Corporation of America is the manufacture of allyl chloride by the direct chlorination of propylene, which is now an initial step in the manufacture of synthetic glycerol. Very pure propylene must be used, and it is chlorinated non-catalytically in the vapour phase at 500°C., at pressures just above atmospheric. The reaction is highly exothermic and takes place in adiabatic reactors with a very short residence time.

There are two methods of converting the allyl chloride to glycerol. The first, briefly, is the chlorhydrination of refined allyl chloride with dilute hypochlorous acid, or a dilute aqueous solution of chlorine, and then hydrolysis with caustic soda to give glycerol. The other method is to chlorinate the allyl chloride further in dilute aqueous solution so as to produce trichloropropane, which may then be hydrolysed to give glycerol.

This production of allyl chloride and allyl alcohol has opened the way to a vast new field of solvents and chemicals, which is probably destined to become of exceptional importance. Among the products that are now being made available are epichlorhydrin, a starting material for the manufacture of solvents for resins, gums and cellulose esters; and acrolein, which, though not a solvent, is a most important intermediate in the synthesis of other chemicals and solvents.

Expansions in Pakistan

THREE sulphuric acid plants, two with a capacity of 10 tons daily and one of 20 tons capacity, will soon be operating in Western Pakistan. They will be located at Karachi, Lyalipur and Rawalpindi (West Punjab). A 10-ton plant for the production of caustic soda by the electrolytic method is also to be established in the near future. This will produce 8.8 tons of chlorine per day. As an additional means of ensuring the regular supply of chlorine for Karachi, the Government has agreed to the establishment of a four-mercury cell plant capable of producing approximately five tons of chlorine per month.

Another matter to which importance is attached by the Pakistan Government is the establishment of a national fuel research institute. Detailed proposals for this have been made by a Czechoslovakian firm, and have been examined and accepted in broad outline by the Government.

Pakistan's production of various petroleum products, which stood at 42,000 tons in 1948, rose to 90,000 tons in 1949 and is expected to rise to 130,000 tons this year. Development of the oilfields of the Punjab, which will enable Pakistan to meet 15 per cent of its total requirements, is to be accelerated.

"Proposed New Hardness Scale"

In the article appearing in last week's issue (*1616*, page 20) under "Krushchov's Scale" the formula was given incorrectly as $H_o = 0.7H^2$. This should have been $H_o = 0.7H^{\frac{1}{2}}$.

Compounding Synthetic Rubbers

Widespread Application of the Zinc Pigments

ZINC pigments play a vital part in the compounding of nearly all rubbers, whether natural or synthetic. Zinc oxide is used as an accelerator, as an activator, as a pigment and for reinforcing. Zinc sulphide and lithopone are most useful as pigments, although lithopone can exhibit quite marked reinforcing effects.

The characteristics of each kind of pigment and the various ways in which they are applied are described and illustrated in "Zinc Pigments in Rubber," the latest publication of the Zinc Development Association.

Among other metallic oxides occasionally used as activators, this review observes, only cadmium and lead oxides have effects comparable to those of zinc oxide. The cost of the former renders it prohibitive for all but very special purposes.

Disadvantage of Litharge

Lead oxide (litharge) has the serious disadvantage of darkening or blackening the product. While this oxide does activate most accelerators, with others it exerts a retarding effect. The lead content of zinc oxide must be kept low to avoid darkening and inequalities in curing properties.

Cadmium compounds retard thiuram accelerators and slightly advance the cure with butyraldehyde ammonia, diorthotolyl-guanide and mercaptobenzothiazole.

Zinc pigments are an essential ingredient in the compounding of practically all synthetic rubbers, observes the ZDA. It classifies these rubbers and some of these properties thus:

Butadiene-styrene rubbers (GR/S) are the greatest competitors of natural rubber and were used extensively during the war. Channel blacks of the type most frequently used with natural rubber are capable of giving high tensiles with GR/S, but there are so many processing difficulties that the so-called easy-processing (EPC) blacks, with or without soft blacks are much more common.

Several workers have found that mixtures of easy-processing black and zinc oxide give higher tensiles than the black alone. A more important discovery, however, was that replacement of one-third of the channel black by zinc oxide reduced heat build-up. The reduction in heat build-up was judged from work on a modified form of flexometer, which is believed to reproduce road test conditions better than some of the instruments used.

Butadiene-acrylonitrile rubbers (GR/A), of which the chief representatives are Hycar and Perbunan, in general swell in oils less than any other rubber except Thiokol. The compounding of these synthetics closely resembles that of GR/S, the chief point of difference being that with GR/A it is usually desirable to use fairly high proportions of plasticiser such as dibutyl phthalate, etc.

Butyl rubber (GR/I), now available in a number of grades, finds its chief application where very low permeability to gases is required as in chemical linings, or where the product will come into contact with strong oxidising agents in service.

Neoprene (GR/M) is the most resistant of all synthetic rubbers to oxidation, sunlight, flame and flexing. It is also highly heat resisting and has only limited swell in most solvents. This swell seldom causes disintegration such as occurs with natural rubber in contact with oils, etc. The function of zinc oxide in this synthetic is totally different. It can be regarded as the main curing agent, thus taking the place of sulphur in natural rubber and the butadiene synthetics.

Oil Resistant

Thiokol (GR/P). The class of synthetic rubbers known as Thioplasts are the most highly oil resistant of all synthetic rubbers. They require zinc oxide in order to cure. Quite small amounts appear to be sufficient, but the makers recommend that a minimum of 10 per cent on the Thiokol be used.

Lactoprene is the generic name covering a very recently developed range of copolymers of acrylates with butadiene, etc. Zinc oxide is here used as a reinforcing agent.

Zinc oxide, says the ZDA report, has been shown to be a most versatile material in compounding both natural and synthetic rubbers. With regard to its behaviour in synthetics—some of which are procurable only in very small quantities—it is highly probable that continued investigation of the compounding and processing technique of synthetic rubbers, together with fuller investigation of different types of zinc oxide, will reveal new uses.

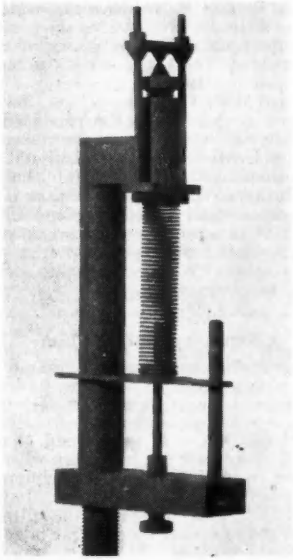
SUCCESSFUL IMPROVISATION

Sensitive Pressure Controller in Hydrocarbon Synthesis

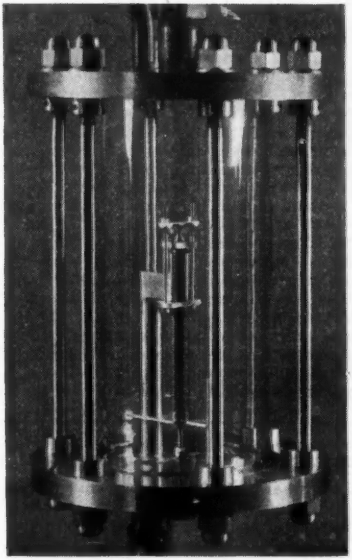
THE possibilities of effective improvisation in chemical engineering were well illustrated recently in the Fuel Research Station of the Department of Scientific and Industrial Research in an instrument produced by Mr. Jack Death, one of the oldest employees there (both in age and service) who devised and made a very sensitive pressure controller. This was aided by his intimate appreciation of the stringent conditions imposed by a newly installed synthesis plant.

This is an experimental fluid bed plant for hydrocarbon synthesis by the Fischer-Tropsch process. It is at present operating at 20 atmospheres pressure, handling flow rates between 2 and 60 cu. ft. per hour, but it may be run at pressures up to 50 atmospheres. The pressure of gas in the apparatus requires to be held constant within very close limits at any level selected, irrespective of the rate at which the gas is flowing from the plant.

Mr. Death had been working for many years on the construction and maintenance



The main components of the valve



The assembled pressure controller in use at the Fuel Research Station. Glass enclosed, it has a low pressure gas outlet at the top

of hydrogenation and synthesis plants, and the original prototype without any modification, which is still in operation after several months' service, represents his own ideas as to the type of controller required in the particular circumstances.

The basic principle of the device is the use of a ball valve held on its seating by a tension spring. This idea is by no means novel—it was probably known to the Romans. Mr. Death has applied his craftsman's skill and knowledge to this well known principle and has succeeded in producing an instrument so efficient that it is being installed throughout the Fuel Research Station wherever sensitive pressure controllers are required.

The high pressure gas comes up through a stand pipe in a glass container. It leaves the stand pipe by a ball valve which is retained in position by a stirrup connected

to a tension spring. The lift of the ball is limited by adjusting to about 0.01 in. the clearance between the lower bar of the stirrup and the stand pipe. The ball housing is coned so as to allow a free escape of the gas into the low pressure receptacle.

The controller is capable of maintaining a pre-selected pressure for indefinite periods, virtually no supervision being required. A certain amount of light oil is exhausted with the gas from the synthesis plant, and the apparatus has proved to be a very efficient oil-fog separator. With 45 turns of a 20 s.w.g. close-coiled, hard-drawn stainless steel wire, the controller is capable of efficient operation with hydrogen at rates of flow ranging from about 5 to 500 cu. ft. per hour at 10 atmospheres, 5 to 900 at 20 atmospheres, and 5 to 1200 at 30 atmospheres.

With 45 turns of a similar wire of 18 s.w.g. the range for hydrogen is from 5 to 1400 cu. ft. per hour at 20 atmospheres, 5 to 2200 at 40, 5 to 2500 at 60. With 18 s.w.g. the range with air is up to 400, 700 and 800 cu. ft. per hour at 20, 40 and 60 atmospheres respectively. These are the extreme limits obtainable with the particular springs on test. For all these rates and pressures the diameter of the stainless steel ball is 1/16 in. When controllers are installed to handle appreciably larger rates of flow, a slight increase in the diameter of the ball is required.

It is not claimed that at the extreme limits quoted the pressure remains constant, because there is a tendency to rise. For example, at 20 atmospheres, a controller fitted with a 20-gauge spring is able to maintain a practically constant pressure at rates of flow up to 300 cu. ft. per hour. There is then a rise in pressure of about two atmospheres up to 900 cu. ft. per hour. With air, this rise in pressure is about three times what it is with hydrogen at the same rate of flow.

This sensitive pressure controller was displayed at the recent Physical Society exhibition and attracted considerable attention, inquiries being received from some very large concerns. It is considered that, on account of its simplicity and reliability, it should be suitable for any applications where a sensitive pressure controller is required.

Standardised Pumping Equipment

NEED for standardisation and interchangeable components is nowhere more apparent than in the provision of pumping services in the large petrochemical undertaking of the Shell group at Stanlow. The measures taken by Sigmund Pumps, Ltd., to meet that need are recorded in a booklet now available.

The large number of pumps involved created a considerable maintenance problem, as it seemed impracticable to have available a spare pump for each duty, as is often done in refineries. All the duties to be performed were, therefore, tabulated and then grouped. Thus, three basic pump designs were selected; a single-stage pump, a two-stage pump and a multi-stage barrel pump. Within these groups steps were taken to keep variations of parts to a minimum by employing the same internal parts in all three groups. There are single-stage, two-stage and multi-stage barrel pumps all employing the same impellers and wear rings, and between single- and two-stage pumps only one bearing assembly is used.

Over three-quarters of all the pumps have only two sizes of bearing assemblies in single- and two-stage pumps. Problems of maintenance during operation are much facilitated by this method and the work of storekeeping reduced to a few categories.

New Petroleum-Based Fungicide

A PETROLEUM-BASED fungicide SR-406, said to be effective against most of the important fungous diseases of plants, is reported to have been successfully developed by the Esso Laboratories of the Standard Oil Company (New Jersey)—where it is expected to be produced commercially in 1951—in co-operation with Rutgers University. Technically, it is N-trichloromethylthio-tetrahydrophthalimide. The Rutgers reports indicate that in tests on potatoes and peaches using solutions from 1 to 10 p.p.m. even the weakest solution prevented about 50 per cent of the fungus spores from germinating, without injury to plants.

Replacing Milk of Lime

The experimental use of Elguanite, said to be a mixture of carbonates, hydroxides and trace elements, to replace milk of lime in sugar-refining, is reported from Hawaii and the U.S.A. It is claimed that the long filtering process, necessary when milk of lime is used to precipitate impurities, is avoided by use of Elguanite. It is also said that clogging of the filters is eliminated and that more sugar is actually produced because Elguanite does not cause raw sugar to turn to molasses, which can occur when milk of lime is used.

Technical Publications

RESULTS of applying electromagnetic and cathode-ray oscillographic recording techniques to the study of certain electrical parameters in the a.c. argon arc process for welding aluminium are given in a paper by L. H. Orton, J. C. Needham and J. H. Cole in the June issue (Vol. 4, No. 3) of *Welding Research*, journal of the British Welding Research Association. Recommendations are also given for the metal-arc welding of butt welds in steel pipe-lines for power plant.

* * *

TRANSLATIONS of German technical data for the manufacture of the wide range of dyestuffs produced by the I. G. Farbenindustrie have been made in a series of reports now listed in research bulletin No. 46, available from the Research Information Service, New York.

* * *

VERSATILE polythene is the subject of an article by Philip A. Novikoff in the June issue of the "C.I.L. Oval" (Vol. 19, No. 3) published by Canadian Industries, Ltd. Other features include a review of the important part played in industrial development by Canada's caustic soda and chlorine production, and the work of the chemist in improving mothproofing and moth control.

* * *

WIDENING uses of a large range of chemical products resulting from continued research and investigation are described in a booklet just issued by the Witco Chemical Co., Ltd. Its intention is to supply in compact form a reference, neither too technical nor too commercial, which may be of use to the buying department and the development chemist.

* * *

CASTINGS in nickel-aluminium bronze as specified in B.S. 1400-AB2-C are comprehensively dealt with in a booklet just issued by The Mond Nickel Co., Ltd., London. Composition-fatigue and corrosion-fatigue properties, machining, welding, brazing and soldering are the subjects of technical reviews amplified with illustrations and diagrams.

* * *

THE engineering achievement which brought the waters of Lochaber to Fort William to generate the hydroelectric power necessary to manufacture aluminium is the subject of an interesting illustrated article in the current issue of "Rope Talks" (No. 23) published by British Ropes, Ltd.

[By courtesy of Murex Welding Processes, Ltd

An electrode holder (type H500) intended to withstand the arduous conditions of heavy duty electric arc welding. It is suitable for currents up to 500 amp., the holder has special long life jaws, overall insulation, and all parts are replaceable. A heavy-duty instrument, it weighs only 24 oz.

USE of chemical fibres in a new context by the Celanese Corporation of America is announced in a leaflet describing the successful application of these fibres, either blended with wool or alone, in the manufacture of carpets. It is claimed that these fibres make possible colour tones of greater brilliance and clarity than have formerly been possible to the rug industry.

* * *

DISCOVERIES which made possible the building up of the chlorantine fast-colour dyes through the introduction to azo chemistry of the cyanuric ring are described in the June issue of the "Ciba Review" (No. 80) published by Ciba, Ltd., Basle. The main feature article is devoted to the history and development of the Lucchese silks.

* * *

WATER keeps the oil industry alive; it takes 23 gallons to refine one gallon of oil. This is one of the facts revealed in Water for Oil in "The Lamp" (Vol. 32, No. 1), published by the Standard Oil Company (New Jersey).

AMPOULES and test-tubes of neutral glass for laboratory, medical and scientific purposes made to the highest specifications are being produced by Laborglass (Pty.), Ltd., Johannesburg. It is hoped as the raw material position improves that a large percentage of local needs will be met.

OVERSEAS CHEMISTRY AND INDUSTRY

INDUSTRY IN ISRAEL

British and American Participation in the New Economy

by H. REIK, M.Sc.(Eng.), A.M.I.Mech.E., A.M.I.E.E.

ISRAEL'S position halfway on the Mediterranean coast line between Turkey and Egypt makes it an ideal centre for the supply and distribution of industrial products to the neighbouring Arab countries, which in turn would be the natural suppliers of agricultural goods and raw materials. That this is not the case at the moment is due to the fact that no final peace treaty has yet been signed. Israel's harbours, the deep sea harbour of Haifa and the two harbours of Tel Aviv and Jaffa, are, however, working to capacity on the territory's imports and exports. The former total about £85 million per annum and the official policy is to reduce the amount of finished products imported by increasing the industrial potential of the country.

OIL AND CHEMICALS

THE agreement to provide sufficient crude oil by shipment to permit operation of the Haifa oil refinery—closed since Egypt forbade the passage of tankers for Haifa through the Suez Canal—marks an important stage of the industrial development of the new State of Israel. An impression of the determined attempts now being made to build up Israel's capacity as a producer and exporter, especially of chemicals and associated products, is conveyed in a series of short articles, based on first-hand observation in Israel, of which this is the first. The second article will deal with prospects of chemical industries and the substantial support which may come from the work of the Weizman Research Institute.

Planning New Industries

The present Jewish population of Israel approaches the 1.1 million mark, with an Arab minority of about 150,000. The Jewish population at the time of the proclamation of the State of Israel (May 15, 1948) was about 670,000. It has thus grown by 65 per cent due to large scale immigration. Work for over 400,000 has to be found, while tackling all the questions concerned with setting up an independent state. The young state recognised quickly that the only way of absorbing such numbers was by planning and encouraging new industries and at the same time assisting existing firms to enlarge their plants and workshops and modernise their methods.

Over 300,000 immigrants have by now been absorbed in the Israel economy, with 80,000 remaining in immigration camps. These are now being transferred to new centres of industry, and citrus areas, and it is expected that the immigration camp population figure will be halved within the next few months.

The Institution of Engineers and Architects in Tel Aviv, which includes all engineers, has set up a separate production and efficiency department which co-operates with corresponding Government bodies, as well as the industrial efficiency department of the Manufacturers' Association, the Israel counterpart of the FBI. This department of the Institute of Engineers has just published its first report on conditions in industry. It criticises severely the tendency of manufacturers to let things stay as they are and to rely on the sellers' market—a state similar to that in England shortly after the war.

The report points out that Israel's industry must become competitive in the world's markets and reduce its production costs by improved methods and machinery. Israel will have to export to balance its payments in the not too distant future and buyers will expect competitive prices. The introduction of time and motion study and incentive systems is recommended.

The Government, a coalition between Labour and Liberal/Conservative parties, has asked for the co-operation of the Manufacturers' Association and the powerful Israel TUC (Histadruth) which embraces both Arab and Jewish workers. The Histadruth differs from the British TUC in that it has its own undertakings like Nesher, the large and modern cement works; Phoenicia, the largest glass plant in the country; Shemen, the vegetable oil works; foundries, and many others, and it is also the largest building contractor in the country. It runs its own health scheme, embracing nearly 60 per cent of Israel's population.

Trade Union Enterprise

One has here the interesting idea of a trade union employing its own members in industrial enterprises. This makes the Government's task easier as the union is

willing and eager to improve production methods, accepts time and motion study and co-operates in questions of industrial relations.

The Government has allocated a large part of the $100 million loan to the acquisition of new plant and machinery. Up-to-date mechanical handling methods are being introduced, conveyors, platform and fork-lift trucks being employed wherever necessary. The harbour authorities in Haifa and Tel Aviv lead the way by introducing large numbers of fork-lift trucks and travelling cranes. Haifa harbour has now over 60 of these trucks, which is a large number even compared with the best British practice.

Technicians and Finance

The level of engineering knowledge and technical skill of the worker in Israel is nearing Continental standards, although many of the new immigrants still need a thorough technical training. A number of trade schools are available, but they cannot cope with the demand and new schools are being opened which, in conjunction with the technical high school in Haifa, will provide the technical personnel for the many new enterprises.

All this expansion depends to a large extent on the investment of foreign capital. American and Continental firms are making use of the special legislation which has been passed in order to facilitate such investments. It is rather strange to see British firms lagging behind in this as they had been a very strong influence on the economic life of the country during the time of the mandate. There are many Israeli firms which would be interested in co-operating with British investors by providing buildings and working capital for extension or new enterprises, while receiving machinery and some raw materials as well as the technical information from the British partner.

In the meantime, American equipment and methods are being introduced, although it is often doubtful whether they are always suited to local conditions. This "American preference" is due to the American loan which specified which equipment should be purchased. British firms have often been disappointed because no sterling releases have been forthcoming for the export of their goods to Israel.

One prominent reason for this dearth of currencies is the fact that Israel's biggest dollar and sterling earner, the huge Haifa refineries, have been standing idle. The direct pipe-line with Iraq has been empty for over two years and only a maintenance staff at the refineries kept the plant in working order. The large generating station has acted as a standby to the Israel grid.

If the refineries are given the crude oil needed, Israel will be able to pay for its oil consumption from the proceeds of the refinery and still keep a surplus of sterling for purchases from Britain. Britain would have millions of dollars. It is very much in the interest of both countries and the

[By courtesy of Anglo-Iranian Oil Co., Ltd.

General view of Haifa Refinery

Middle East that these refineries should work at full capacity.

Israel's main export is still citrus fruit, of which Britain is the main buyer, and our trade and relations with Israel should improve as soon as these difficulties are removed.

The following is a summary of the provisions framed to encourage capital investments in Israel:—

An investment centre has been set up which furnishes information for intending investors and examines proposals for investment from the viewpoint of Israel economy. It can approve of the investment and maintain contact between investors and Government offices in all matters connected with capital investment. Approved investments or undertakings are exempted from urban and rural property taxes for five years. They will enjoy special rates of depreciation on buildings, machinery and equipment.

The ceiling on income tax rates for the first five years will be 25 per cent and the Minister of Finance may, in special cases, refund to a company part of the income tax paid. The import of machinery, plant and raw materials necessary for the enterprise will be given special consideration. Relief from company registration and land transfer fees is granted.

Where a non-resident makes an approved investment in foreign currency, the Minister of Finance may grant him permission to transmit up to 10 per cent of the invested capital per annum in his own currency on account of capital, profit, interest or depreciation of the investment. Where a non-resident goes to settle in Israel, the Minister of Finance may exempt for a period of seven years from the obligation of offering foreign currency to the Ministry of Finance.

The following goods can be exempted from import duty if needed for an approved undertaking: Plant; installations; machinery; pre-fabricated structures and houses for industrial undertakings or warehouses; raw material; building materials; and semi-manufactured goods of a kind not made in Israel.

Chilean Nitrate Prices Raised

AN increase in price of both industrial and agricultural Chilean nitrate of soda was announced on July 1 by the Nitrate Corporation of Chile, Ltd.

Industrial sodium nitrate, 97-98 per cent. crystal and granulated, in 6-ton lots, delivered in Great Britain was raised from £20 10s. to £23 per ton (2240 lb. gross). Additional surcharges on smaller lots will be made as follows: four tons and over, but less than six, 2s. 6d. a ton; two tons and over, but less than four, 5s. a ton; one ton and over, but less than two, 10s. a ton; two cwt. and over, but less than one ton, 20s. a ton.

Prices of agricultural sodium nitrate crystal and granulated, in 6-ton lots, delivered (c.i.f., main ports Isle of Man), was increased from £11 to £19 17s. 6d. a ton gross weight. Additional charges for smaller quantities are the same as those on industrial brands.

U.S. Sulphur

According to the U.S. Bureau of Mines, the domestic sulphur industry produced 389,305 long tons of native sulphur during April. Mine shipments of 497,770 long tons approached the record figures of November 1946, while apparent sales were estimated at 492,538 long tons, the largest for a single month. Producers' stocks continued to decline, and at the end of April were 2,885,294 long tons.

Gas Kills Eleven

GAS, escaping from a furnace at the Consett Iron Company's works on the night of July 1, killed 11 men, and incapacitated 34 others, who were removed to the Shotley Bridge hospital. Six were allowed to go home after treatment, but the remaining 28 were detained.

It was stated by a company official that such gas had approximately the same specific gravity as air, and had no smell, and it was possible that the men were not aware of its presence until they were overcome. The escape occurred just after a new shift had started and the men were affected in a few minutes. According to a time-keeper, there were only five men working in the foundry loading bay. His opinion was that most of those killed were, in fact, trying to rescue others.

Two men were found dead in a kiln at a Middlesbro' ironworks on June 28. It is believed that the men, who were not employed at the works, were overcome by gas while sleeping in the kiln.

German Refinery to be Expanded

A cracking unit is being installed at the Heide (Schleswig-Holstein) refinery plant of the Deutsche Erdoel A.G. at a cost of about Dm.15 million. Motor fuel output of the works is to be stepped up to 130,000 tons p.a., and some 60,000 tons of diesel oil are also to be manufactured annually.

The Chemist's Bookshelf

JOURNAL OF THE ELECTRODEPOSITORS' TECHNICAL SOCIETY. Volume 24, 1948-49. London: Published by the society at 27 Islington High Street, N.1 Pp. 232, 8vo; 2 gns.

There can be few technical societies of top rank, such as the ETS undoubtedly is, in which management expenses are so low and efficiency so high. Salaries and clerical assistance amount to £319 10s. 3d. It is evident that there must be a great deal of very able honorary work by members of council and committees, and keen and zealous co-operation by everyone concerned. This is reflected in a net increase in membership for the last year of 113, bringing the total to about 1000, and the society's generally healthy condition.

The papers in the present volume, already issued in separate form, maintain the high standard set by their predecessors, are eminently practical and are based both on wide experience and on scientific research. In most cases they have evoked keen and informative discussions. As noted in a previous review, it is not apparently possible to print discussions in their proper place at the end of relevant papers. They are mostly lumped together at the end, each with a reference to the pages of the paper discussed. It might be well also to have a reference at the end of the paper to the discussion page. A wide range of interesting subjects is covered, including two papers on barrel polishing, a process still lively and progressive and holding its own very well.

A somewhat ancient technique, but also vigorous and progressive, is that of phosphating, on which H. A. Holden (Pyrene Co., Ltd.) contributes a valuable report of recent progress. Although phosphating has been the subject of innumerable papers in the technical Press and of many patents throughout the world in the last decade or two, this is the first time in five years that it has come before the ETS. The report contains some account of new solutions and also the application of phosphating to lubrication and cold-working on which much interesting work continues. New solutions and methods include some that can be used for aluminium as well as zinc and steel. At the time the paper was presented, patents were pending for some of these—apparently improved Bonderising methods—(*see also* Gibson *et al.*, *Ind. Eng. Chem.*, 1946, 38 (12), 1222-7).

The paper by Dr. S. Wernick and co-workers on blistering of electrodeposits on zinc alloy die castings deals with one of the most persistent and troublesome problems in plating these die castings. It is illustrated by a remarkable series of micro-photographs showing different forms of corrosion and blisters. On the subject of corrosion, too, another valuable and practical paper is that of V. Evans on tank linings and insulating materials. Synthetic resin linings, especially PVC, polythene and Perspex, continue to be of promising interest, and indeed have got beyond the promising and reached the accomplished stage. There is, however, always room for further improvement and wider application.

Other papers include two on polishing, and several on general plating, chemical colouring, l.t. power supply, welding, etc., of coated metals, and oxide coatings on aluminium. This is certainly a valuable compendium, but the price of two guineas to non-members may prohibit its fullest distribution.

European Steel and Coal

THE facts bearing upon the need of some form of co-operation for economic co-ordination of the European steel and coal industries are surveyed in the "Monthly Statistical Bulletin" (Vol. 25, No. 5) of the British Iron and Steel Federation. The report shows in detail the extent to which some countries are over-supplied either with iron ore or coking coal and confirms that no European country is independent of outside supplies of both. Outstanding is the dependence of France on imported coal and of Germany and the U.K. on foreign iron ore. Among smaller countries the deficiencies are proportionately greater, Belgium, the Netherlands and the Saar having no iron ore, while Luxembourg, Italy and Sweden have no coal.

OVERSEAS

Protection for Vegetable Crops

A report from a Goodrich subsidiary company at Cleveland claims the development of a new chemical which, applied to vegetable crops, will ward off attacks by rabbits and rodents.

New Argentine Oil Deposit

A prolific new oil deposit, yielding about 150,000 litres of crude oil per day, is reported to have been discovered by the Argentine State Oil Company Y.P.F. at Punta Piedras in the oil region of Comodoro Rivadavia at a depth of 2307 metres.

W. German Fat Research

A new institute for fat research has been established in Münster (British zone). Its main activities will be to investigate the utilisation of fats and to examine manufacturing methods. It replaces the former Reichsinstitut which was closed in 1945.

French Steel Pipes for Mexico

The Mexican Foreign Trade Bank is reported to have concluded an agreement with the French Government for the delivery of steel pipes, required for the Tehuantepec pipe-line, valued at one million dollars. Delivery is to be effected within about two months.

Spain Producing Esparto Wax

At the recent Valencia Sample Fair was shown a new wax made from esparto grass for which properties similar to those of carnauba and candelilla waxes are claimed. It is said to be hard and suitable for use in the manufacture of carbon paper, polishes, cosmetics, leather dressings, etc.

Jugoslav Penicillin

The Jugoslav Public Health Council has completed tests of home produced penicillin which are reported to have been satisfactory. Large-scale production is to begin at once. A laboratory has been equipped also for the manufacture of urotropin by the Belishche Timber Processing Combine, near Osijek.

Recovery of Cassella Dyeworks

The volume of output of the 80-year old Cassella Dyeworks, at Mainkur, Frankfort a/M., Germany—a leading unit of the former I.G. Farbenindustrie—is reported to have almost reached its pre-war level. Over a third of the total sales is being exported, and about 100 new items have been included since the war in the company's manufacturing programme which gives employment to more than 1550.

Test Drilling in Jugoslavia

Reports from Jugoslavia state that drilling for oil is planned in the Ulcinj region on the coast of Montenegro. It is hoped that total output will reach 400,000 metric tons in 1951.

Sterilisation by Electrons

It is reported from the U.S.A. that antibiotics, such as penicillin and streptomycin, are being sterilised by electron bombardment from a 2 million volt atom accelerator.

Marshall Aid Cargoes

Included in recent cargoes shipped to the United Kingdom under Marshall Aid auspices were: carbon black, 2803 tons; steel, 403 tons; aluminium, 3783 tons; copper, 1570 tons; zinc, 1090 tons.

New Rust Inhibitors

Two new rust inhibiting white lead pigments, non-reactive toward vehicles containing free carboxyl groups, have been introduced for the paint and varnish industry by the Monsanto Chemical Company, St. Louis, Missouri. It is producing commercial quantities of trilead orthophosphate and dilead pyrophosphate. They are said to be among the few rust inhibitors which do not react with solution coatings composed of a polyvinyl chloride-acetate copolymer modified with a dicarboxylic acid.

Industrial Casualties

DEATHS from industrial accidents reported in May showed a decrease both from the previous month and from the same period last year. The total in May was 103 against the revised figures for April of 114 and May, 1949, of 167.

There were only four deaths in chemicals, oils, soaps, etc.; metal extracting and refining accounted for three, and metal conversion and founding for nine; there were five in gas works and one each in textile manufacture and textile printing, bleaching and dyeing.

Industrial diseases reported in May under the Factories Act, 1937, or under the Lead Paint (Protection against Poisoning) Act, 1926, showed only one death; this was in the oil industry due to skin cancer (epitheliomatous ulceration). The number of cases reported totalled 41, of which 18 were ascribed to skin cancer (pitch, 12; tar, 4; oil, 2).

HOME

Coal Production

Production of deep-mined coal last week increased by 42,300 tons over the previous week. Comparing figures are:—Last week: 4,305,700 tons (deep-mined 4,031,700 tons, opencast 274,000 tons). Previous week: 4,271,400 tons (deep-mined 3,989,400 tons, opencast 282,000 tons).

£100,000 for Research Fund

Appreciation of the dependence of industrial development upon research is evinced in the report of the directors of Bakelite, Ltd., in which it is mentioned that a new reserve was set up by the company in 1949, the "scientific research reserve," to which £100,000 has been transferred from the general reserve.

Imports from Belgium and Luxemburg

Licences for the import of goods from the Belgo-Luxemburg Economic Union will continue to be issued by the Board of Trade on the scale which has been operating under the arrangements reached in February with the Belgian and Luxemburg authorities for the period ended June 30. Financial arrangements are also being continued for the time being on the present basis.

Oils and Fats

The Ministry of Food announces that no change will be made in the prices of unrefined oils and fats and technical animal fats allocated to primary wholesalers and large trade users during the five week period ending August 5. The Ministry states that its stocks of castor oil are now exhausted and the published prices of £115 per ton for "firsts" and £108 per ton for "seconds" are therefore withdrawn. The Ministry is offering hardened whale oil No. 3, 40/42°, at £100 per ton naked ex works.

U.K. Copper Prices

No increase in price of U.K. copper will be made at present despite the rise in the U.S. domestic price following the reimposition of American import duty on July 1. This decision was announced by the Ministry of Supply after discussions with Rhodesian producers, who stated that they did not wish to take advantage in their pricing arrangements of any increase due to the American duty. Further discussions will take place as soon as an assessment can be made of the effect the duty has had on American prices.

Explosion Inquest Postponed

The inquest on the two victims of the explosion at Monsanto Chemical Works, Cefn Mawr, on June 26, was opened at Wrexham, on June 28 and adjourned provisionally until September 6. The coroner's expression of sympathy with the relatives was endorsed by Dr. W. D. Scott (deputy managing director of the Monsanto Company).

Transport's Influence on Materials Costs

A further indication of the effect of recent increases in rail and road transport charges on the cost of materials is provided by the new prices notified by Widnes Foundry & Engineering Co., Ltd. The selling prices of Class A castings have been increased by 9d. per cwt. as from July 1. Special low phosphorus and acid resisting castings will be subject to special increases.

Mechanical Engineers Visit G.E.C.

Members of the Institution of Mechanical Engineers, during their recent summer meeting at Birmingham, visited the Witton works of the General Electric Co., Ltd. During the tour the visitors also saw the high power testing station and inspected the 75,000 k.V.a. transformers and hydrogen-cooled alternators being constructed for Uskmouth Power Station.

Chemical Employment

Numbers employed in the chemical and allied trades in April remained steady, (in thousands) 444.0 compared with 443.7 in March. Analysis of these figures in the *Ministry of Labour Gazette* showed the following distribution: coke ovens and by-products 17.1; chemicals and dyes 202.8; pharmaceuticals, etc., 34.0; explosives, etc., 36.9; paint and varnish 38.3; soaps, glycerin, etc., 48.0; mineral oil refining 36.2; oils, greases, glues, etc., 30.7.

Synthetic Detergents

Reporting increased sales of synthetic detergents in 1949, Lever Bros. and Unilever, Ltd., observes that its development of this work was hampered to some extent by shortage of some chemicals and unsuitable quality of some other materials, except from dollar sources. The annual report notes that "the ultimate level of acceptance of synthetic detergents remains to be determined; only when adequate supplies both of soap and synthetic products are available will the housewife be able to make up her mind on the basis of price and effectiveness."

PARLIAMENTARY TOPICS

QUESTIONED about the achievements of the Hydraulics Research Organisation since its inception four years ago, Mr. Herbert Morrison, Lord President of the Council, said that marked advances in instrumentation had been made. These included methods for the continuous measurement of velocities in sea and streams and the development of a pneumatic tide generator which could reproduce any desired tidal conditions. Basic problems under investigation include: characteristics of natural water channels, problems of coast erosion and the behaviour of channels in estuaries.

NEED for greater care in the handling of DNOC when applied as a spray for grain crops was again emphasised in the House of Commons. In a written answer, Mr. T. Williams, Minister of Agriculture, said that precautions for the use of DNOC and similar substances had been given wide publicity by his department. A new leaflet was in preparation, and investigation was in progress with the interests concerned as to any further steps which might be necessary.

MR. HECTOR McNEIL, Secretary of State for Scotland, said he was considering whether further legislation was needed to deal with the emission of fluorine fumes by factories in Scotland. He was replying to several questions, in the course of one of which Lord Malcolm Douglas-Hamilton alleged that there were harmful discharges which required fresh legislation and there was not the same protection as the law afforded in England.

Personal

SIR IAN HEILBRON, chairman of the Advisory Council of Scientific and Industrial Research, has been elected a foreign member of the Royal Netherlands Academy of Sciences and Letters.

COMMANDER J. H. F. KENT, R.N.(Retd.), has been re-elected president of the Retread Manufacturers' Association for 1950/51. Mr. Ronald H. Pike, chairman of the technical advisory committee which drew up the association's code of minimum standards for retreading, has been re-elected vice-chairman.

The National Coal Board has appointed LORD ADAMS and MR. WILLIAM HODGSON to be part-time directors of the Northern (N & C) divisional board, which administers the coalfields of Northumberland and Cumberland.

WINTER ELECTRICITY

THE Electricity Sub-committee has decided that load-spreading arrangements applicable to industries will again be necessary this coming winter, but to a lesser extent than in previous years. It is considered that the position has so improved that the morning peak hours will be confined to the period 8—9.30 a.m., though care will be necessary up to noon, and during December, January and February reduction in load of at least 10 per cent will be needed. The afternoon peak hours remain unchanged at 4—5.30 p.m., when a reduction of 10 per cent will be required from December to mid-January. Where local circumstances make it necessary, the Regional Boards will have discretion to require a reduction in load of more than 10 per cent. The estimates of consumption next winter are based upon the maximum demand which would have been made last winter had there been no reduction then by load spreading.

New Food Labelling Regulations

A NUMBER of changes have been made by the Ministry of Food in the Labelling of Food Order, 1950, which comes into force on November 1. The principal change in the new order, which re-enacts the Labelling of Food Order, 1946, is the omission of the weights and measures regulations.

Among the more important provisions are these:

Liquors for which tonic, restorative or medicinal properties are claimed, or which are held out to be of special benefit to invalids, must be labelled with a statement indicating the quantity of the ingredients on which the claim is based.

Concentrated acetic acid must comply with certain special labelling requirements.

Tonic properties may not be claimed for any food on the sole grounds that the food contains (a) alcohol, (b) sugars or other carbohydrates, (c) protein or substances prepared by hydrolysis of protein or (d) caffeine or other purine derivatives.

Sharing Technical Knowledge

The successful exhibition of its technical literature, "I.C.I. as Publisher" first seen in London, was opened by Imperial Chemical Industries, Ltd., in Glasgow recently. The Lord Provost, M. Victor Warren, speaking at the opening, referred to the company's vast output of technical literature and its willingness to make available the results of its research.

The Stock and Chemical Markets

BUSINESS in stock markets has remained on a restricted scale owing to the general tendency to await developments in Korea. There has been no heavy selling, apart from the gold mining and other speculative sections, which have reacted sharply again. British Funds were lower on balance, largely because they were a rising market prior to the Korean news, and there has since been a good deal of profit-taking by financial institutions. This week sentiment in the Gilt-edged market has had the benefit of news of the increase in the gold and dollar reserve figures, but £37.5 million had to be found for the 25 per cent instalment in respect of the £150 million British Electricity 3½ per cent loan.

Most chemical and allied shares have kept steady, movements generally not exceeding more than a few pence. Imperial Chemical eased to 40s. at one time, but have since firmed up to 40s. 6d. Monsanto held up well again at 49s. 6d. and Brotherton 10s. shares were well maintained at 20s. Laporte Chemicals 5s. ordinary were at 9s. 9d. again, at which there is a yield of 4½ per cent on the basis of the 8¾ per cent dividend. This represented a very conservative payment, because earnings on the shares were fully 26 per cent.

Albright & Wilson 5s. ordinary were steady at 28s. 6d., F. W. Berk 2s. 6d. shares were at 15s. 6d. and Boake Roberts 5s. at 26s. Bowman 4s. ordinary were 5s. 3d., Pest Control 5s. shares 7s. 9d. and Fisons steady at 26s. British Glues & Chemicals 4s. shares showed firmness at 21s. 9d., the market expecting the financial results to create a good impression. Borax Consolidated were firm at 55s. 6d. but Turner & Newall eased to 81s. 6d.

Lever & Unilever, at 41s. 3d., remained under the influence of the good financial results, and Lever N.V. were 39s. British Aluminium at 39s. 6d. held up quite well and United Glass Bottle (75s.) continued to hold their recent improvement. There was a fair amount of activity around 23s. in Triplex Glass, awaiting the financial results. United Molasses came back to 42s. 3d. and Glaxo Laboratories to 47s. 9d. British Oxygen at 96s. 9d. have been quite well maintained.

Shares of companies connected with plastics were inclined to ease. De La Rue 5s. ordinary were 23s., at which there is a yield of over 10½ per cent on the basis of last year's 50 per cent dividend. British Xylonite were 75s. and British Industrial Plastics 2s. shares 6s. 9d., at which there is a yield of 6⅜ per cent based on last year's 20 per cent dividend.

There were small declines in iron and steel shares earlier in the week, awaiting the results of John Summers' £5 million debenture issue. It is pointed out in the market that at current levels iron and steel shares offer attractive yields, and that there are good prospects of dividends being maintained. Moreover, if after all steel were nationalised, shareholders would have more than current market prices for their shares, bearing in mind that take-over prices already fixed are well in excess of current levels. United Steel, for instance, are now changing hands around 25s. 6d. in the market and their take-over valuation is 30s. 4d.

Boots Drug at 46s. 6d. strengthened because of the good impression created by the financial results and the strong balance-sheet position. British Drug 5s. shares at 7s. 6d. have been steady, but Beechams deferred eased to 12s. 6d. Oil shares were lower on balance, Anglo-Iranian being ¼ down at 6⅜ on terms of the new concession agreement with Iran. Shell also eased and Ultramar Oil came back to 12s. 6d.

Market Reports

THERE has been no outstanding feature in the industrial chemicals market during the past week, the demand both for home and export continuing fairly steady. Contract delivery specifications are well up to schedule and there is an increasing interest in new forward business. Quotations generally remain unchanged and the undertone is firm. An exception is the lead compounds, which have been further reduced with the decline in the price of the metal. The convention basis price for red lead is now £107 per ton and for white lead £116 10s. per ton. Rather more active conditions are reported in the coal tar products market, with pitch and creosote oil in good call. Prices are steady at recent levels.

MANCHESTER.—Trading conditions on the Manchester chemical market continue under seasonal holiday influences, which have made themselves felt both in the aggregate weight of chemicals taken up against contracts and in the volume of new business. The market otherwise has been fairly active, with delivery specifica-

(continued on next page)

Law and Company News

Commercial Intelligence

The following are taken from the printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described herein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages or Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

AFFINED BASIC CHEMICALS, LTD., London, W. (M., 8/7/50.) June 8, £22,000 mort., to Legal and General Assce. Soc., Ltd.; charged on land and factory premises at Newland Meadow and land and factory premises at Newland known as Empire Works, both High Wycombe. *Nil. Dec. 8, 1949.

Increases of Capital

The following increases in registered capital have been announced: Chemical & Carbon Products, Ltd., from £1000 to £10,000; M. V. A. Laboratories, Ltd., from £5000 to £20,000; Epsylon Research & Development Co., Ltd., from £100 to £20,100.

Change of Name

The name of Unifloc Reagents, Ltd., 2/3 St. Mary Street, Swansea, has been changed to Unifloc, Ltd.

Company News

Amber Chemical Industries, Ltd.

Net profit of Amber Chemical Industries, Ltd., for the year was £19,552 and the balance after allowance for taxation £13,845. The interim and final dividend (each 5 per cent) on ordinary shares is £4950, leaving a balance carried forward of £6145.

A.P.V. Co., Ltd.

Net profit of the A.P.V. Co., Ltd., for the year ending December 31, 1949, was £296,363, compared with £270,898 for the previous year. A final dividend of 8d. per share on ordinary share capital was recommended, following an interim dividend of 4d. a share. At a subsequent extraordinary general meeting resolutions were passed providing that the capital of the company be increased to £1,650,000 by the creation of 11,750,000 ordinary shares of 2s. each; that £288,552 of the undivided profits be capitalised and distributed among shareholders by paying up in full at par 2,885,520 ordinary shares (four for every existing share held).

Coalite and Chemical Products, Ltd.

Net profits, for year ended March 31, of Coalite and Chemical Products, Ltd., were £136,243, compared with £138,472 last year. A final dividend of 3 per cent on the ordinary shares has been recommended, making, with the interim dividend of 3 per cent already paid, a total dividend for the year of 6 per cent (same).

Bakelite, Ltd.

Net profit for 1949 of Bakelite, Ltd., was £220,366, compared with £202,348 in 1948. A final dividend of 13 per cent, making, with the interim dividend already paid, a total of 18 per cent for the year, has been recommended. This is the same as in 1948.

The Bleachers' Association, Ltd.

Net profit of the Bleachers' Association, Ltd., for the year ending March 31, was £364,117 (£297,763). A jubilee bonus of 2½ per cent (£26,254) was added to the ordinary 5 per cent dividend (£52,508), and an award of £25,000 was made to the staff.

Forster's Glass Company, Ltd.

Net profit of Forster's Glass Co., Ltd., for the year ending March 31, was £48,000 (£49,100). The ordinary dividend is 16¼ per cent (£27,930).

THE STOCK AND CHEMICAL MARKETS

(continued from previous page)

tions from the textile and allied industries in the area coming forward freely. Prices generally remain on a firm basis. There has been only a moderate business placed during the past week in the fertiliser market, but as this is the off-season period it is early yet to attempt to estimate the effect of the substantial rise in prices which came into force last Saturday. Most of the tar products are meeting with steady demand.

GLASGOW.—Business generally has improved considerably over the past week. The export market has also shown renewed activity.

Patent Processes in the Chemical Industry

The following information is prepared from the Official Patents Journal. Printed copies of specifications accepted will be obtainable, as soon as printing arrangements permit, from the Patents Office, Southampton Buildings, London, W.C.2. at 2s. each. Higher priced photostat copies are generally available.

Complete Specifications Accepted

Fluorescent material.—British Thomson-Houston Co., Ltd. (General Electric Co.). Jan. 19, 1945. 641,212.

Production of energy through nuclear fission of uranium.—Centre National de la Recherche Scientifique. March 26, 1946. 641,216.

Separation of fatty oil substances.—Texaco Development Corporation. July 11, 1946. 641,220.

Manufacture of modified starch.—National Starch Products, Inc. Aug. 29, 1946. 641,222.

Magnesia insulation and method of manufacturing same.—A. H. Stevens (Johns-Manville Corporation). Nov. 15, 1946. 641,415.

Manufacture of crystalline mixed sulphates.—Communication Engineering Pty., Ltd. March 17, 1947. 641,237.

Manufacture of 8; 8-dichlor-8; 8-diacetodipropyl ether and 4-methyl-5-β-hydroxyethyl-thiazole.—Merck & Co., Inc. April 9, 1947. 641,426.

Electric dry cells.—Naamlooze Vennootschap Philips' Gloeilampenfabrieken. April 10, 1947. 641,427.

Distillation of water.—R. Andersen. April 11, 1947. 641,429.

Fuel agglomerate and its method of manufacture.—A. Vloeberghs. April 12, 1947. 641,166.

Compounds containing a thiophene nucleus and process for the production thereof.—Texaco Development Corporation. April 22, 1947. 641,239.

Cellulose products.—Rayonier, Inc. May 15, 1947. 641,242.

Production of photographic dye images.—Kodak, Ltd., and A. K. Soper. May 21, 1948. 641,355.

Aldonate compositions and method for the production thereof.—Poor & Co. May 28, 1947. 641,435.

Process for handling acetylene safely and employing it with safety in chemical reactions especially in the production of vinyl ethers.—General Aniline & Film Corporation. May 31, 1947. 641,436.

Process for the production of N-vinyl compounds.—General Aniline & Film Corporation. May 31, 1947. 641,437.

Process for the production of vinyl esters of organic acids.—General Aniline & Film Corporation. May 31, 1947. 641,438.

Oil-soluble metal salt compositions and method of making same.—Nuodex Products Co., Inc. June 10, 1947. 641,168.

Process for the manufacture of di-isopropyl-benzene hydro-peroxides and products resulting therefrom.—Distillers Co., Ltd., E. G. E. Hawkins, D. C. Quin, and F. E. Salt. June 24, 1948. 641,250.

Method for the production of basic substances for ion exchangers.—Norsk Hydroelektrisk Kvaelstofaktieselskab. July 4, 1947. 641,173.

Wetting agents or detergents.—Standard Oil Development Co. July 8, 1947. 641,439.

Process for the simultaneous production of algin, alginates, iodic salts of algae, salts of algae free from iodine and organic iodine utilising seaweeds relating to the group of Phaeophyceae.—Prosolmer Soc. Anon. July 14, 1947. 641,440.

Gas cleaning devices of the cyclone type.—C.U.R.A. Patents, Ltd., and F. F. Ross. Dec. 24, 1948. 641,357.

Polymers and process of producing same.—B. F. Goodrich Co. Aug. 1, 1947. 641,442.

Stabilisation of unsaturated ketones.—Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij. Aug. 5, 1947. 641,443.

Metalation of halogenated thiophenes.—Socony-Vacuum Oil Co., Inc. Aug. 26, 1947. 641,260.

Catalyst and method of producing same.—Standard Oil Development Co. Sept. 2, 1947. 641,261.

Alpha-cyano-alkyl esters of monocarboxylic acids and process of preparing same.—B. F. Goodrich Co. Sept. 8, 1947. 641,264.

Catalysts for the synthesis of hydrocarbons.—Standard Oil Development Co. Sept. 19, 1947. 641,266.

Alkenyl silane interpolymers.—British Thomson-Houston Co., Ltd. Oct. 13, 1947. 641,268.

Manufacture of refractory substances.—Birmingham Small Arms Co., Ltd., P. H. Lawrence, J. R. Rait and E. Bates. Oct. 16, 1948. 641,187.

Preparation of derivatives of phenthiazine.—Soc. des Usines Chimiques Rhone-Poulenc. Nov. 20, 1947. 641,452.

Processes for use in coating ferrous metal surfaces.—Poor & Co. Nov. 24, 1947. 641,191.

Photographic elements.—E. I. Du Pont de Nemours & Co. Nov. 26, 1947. 641,368.

Preparation of hydroxyl polymer silver halide emulsions.—E. I. Du Pont de Nemours. Nov. 26, 1947. 641,369.

Tertiary amines and methods for obtaining the same.—Parke, Davis & Co. Nov. 27, 1947. 641,454.

Pressure treatment of materials for changing the gas content thereof.—J. A. Johnson. Dec. 6, 1947. 641,375.

Diazotype dry strip film.—General Aniline & Film Corporation. Dec. 8, 1947. 641,273.

Film drying process for the preparation of pulverised or scaly products.—Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij. Dec. 10, 1947. 641,455.

Stabilised aryl diazo-n-sulphonate light-sensitive material.—General Aniline & Film Corporation. Dec. 29, 1947. 641,276.

Method of producing molybdenum.—Westinghouse Electric International Co. Jan. 6, 1948. 641,379.

Preparations for use in agriculture and horticulture.—H. van Issum and W. F. Fuhrhop. Jan. 3, 1949. 641,280.

Production of polymeric materials.—Imperial Chemical Industries, Ltd., A. Burness and E. G. Williams. Jan. 19, 1949. 641,284.

Germicidal detergent composition.—General Aniline & Film Corporation. Feb. 20, 1948. 641,297.

Coloured cellulose ester or ether textile materials.—H. C. Olpin and W. B. Miller. Feb. 21, 1949. 641,459.

Apparatus used in contact with molten glass.—Mond Nickel Co., Ltd., and E. C. Rhodes. Feb. 21, 1949. 641,299.

Preparation of amalgams.—H. G. C. Fairweather (Guldsmeds Aktiebolaget i Stockholm, G. A. B.). Feb. 23, 1948. 641,300.

Solid, glass-like polymers.—Imperial Chemical Industries, Ltd., E. R. H. Jones, M. C. Whiting, H. P. W. Huggill, and D. B. Kelly. March 7, 1949. 641,310.

Coating of solid particles with liquid.—Foster, Yates, & Thom, Ltd., and H. Dowell. April 23, 1949. 641,317.

Compositions comprising an oil phase and an aqueous phase.—Lever Bros. & Unilever, Ltd. May 11, 1948. 641,203.

Production of polymeric esters.—Courtaulds, Ltd., F. Reeder and E. R. Wallsgrove. May 11, 1949. 641,320.

After-treatment for diazotype prints.—General Aniline & Film Corporation. May 25, 1948. 641,323.

Process for the production of moulded catalysts.—Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij. July 6, 1948. 641,332.

Moulded catalysts.—Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij. July 7, 1948. 641,333.

Photographic developer containing a negatively substituted aralkylamine and process of development.—General Aniline & Film Corporation. Aug. 21, 1948. 641,405.

Process for the treatment of magnesium and its alloys.—Regie Nationale des Usines Renault. July 29 1946. 641,544.

Preparation of melamine.—American Cyanamid Co. Aug. 28 1946. 641,643.

CLASSIFIED ADVERTISEMENTS

SITUATIONS VACANT

CHEMICAL ENGINEERS. Excellent prospects and permanency offered to experienced Chemical Engineers by The Bahrein Petroleum Company Limited, Persian Gulf. Applicants must possess a B.Sc. Degree or equivalent from a recognised Engineering School. Men, who in addition to their Chemical Engineering training, have had training in Mechanical Engineering and practical experience in designs problems applicable to the distillation and fractionation of hydrocarbons common to crude oil and coal-tar refining or chemical plants and other allied industrial processes, are preferred. Salaries according to qualifications and experience, plus kit allowance, provident fund, free board, air-conditioned living accommodation, medical attention and transportation costs. Agreements, 24 to 30 months, with paid leaves. Write, giving full particulars of qualifications age, education, experience and salary required, to **Box 3427, c/o Charles Barker & Sons, Ltd., 31, Budge Row, London, E.C.4.**

CIVIL ENGINEERS. Excellent prospects and permanency with Bahrein Petroleum Company Limited, for Civil Engineers not over 40 years of age with Degree and experience of design and erection of steel and reinforced concrete supporting structures as encountered in oil refinery or similar heavy chemical process plants. Twenty-four to thirty months agreements, with passages paid, kit allowance, provident fund, paid leaves, free messing and air-conditioned accommodation. Low living costs. Write, with full particulars of age, experience, education and salary required, to **Box 3428, c/o Charles Barker & Sons, Ltd., 31, Budge Row, London E.C.4.**

DESIGNS ENGINEERS. Excellent prospects and permanency with Bahrein Petroleum Company Limited, for Mechanical Engineers, not over 40 years of age, with B.Sc. Degree or equivalent qualifications. Experience required in design and/or construction of oil refineries, coal-tar, chemical distillation plants, or similar involving electrical and steam systems, pressure vessels, fractionating columns, heat exchanges and pumping equipment. Twenty-four to thirty month agreements, with passages paid, kit allowance, provident fund, paid leaves, free messing and air-conditioned accommodation. Low living costs. Write, with full particulars of age, experience, education and salary required, to **Box 3429, c/o Charles Barker & Sons, Ltd., 31, Budge Row, London, E.C.4.**

THE CIVIL SERVICE COMMISSIONERS invite applications for two permanent appointments as **EXAMINER**(Male). in the Ministry of Fuel and Power.

Candidates must be at least 25 and under 35 on 1st June, 1950, with extension for regular service in H.M. Forces. They must possess an honours degree in physics with chemistry as a subsidiary subject, or an honours degree in chemistry with physics as a subsidiary subject. Some post graduate research experience would be an advantage.

Salary scale £475-750. Starting pay is linked to age 25 with addition of £25 for each complete year of age above 25 subject to a maximum of £600.

Further particulars and application forms from the **Secretary, Civil Service Commission, Scientific Branch, Trinidad House, Old Burlington Street, London, W.1,** quoting No. 3175. Completed application forms must be returned by 3rd August, 1950.
7556/150/MM.

SITUATIONS VACANT

MINISTRY OF SUPPLY invites applications from **PHYSICAL CHEMISTS** for unestablished appointment in **EXPERIMENTAL OFFICER CLASS** in Industrial Explosives Section of a Research and Development Establishment in London.

Minimum qualification is Higher School Certificate: applications also invited from candidates in possession of qualifications such as Higher National Certificate or a degree in Chemistry. Experience in explosives technique is necessary and a practical knowledge of methods, including electronic methods, for measuring transient pressure is desirable.

Salary according to age, qualifications and experience within ranges:

Experimental Officer, £525-£675.
Assistant Experimental Officer £230-£490.
Minimum age for E.O. grade, 28 years.
Rates for women somewhat lower.

Apply for Application Form to the **Ministry of Labour and National Service, Technical and Scientific Register, (K) York House, Kingsway, London, W.C.2.** quoting F.410/50/A. Closing date 7th August, 1950.
H.Q. 970-25 6/50. D.C.

OIL REFINERY CONTRACTORS handling large contracts for refinery plant, require **CONTRACTS ENGINEERS** in their London office. Duties involve broad direction and co-ordination of all phases of the work, including planning, drafting, purchasing, progressing and erection. Desirable qualification is previous experience of refining industry or heavy engineering including a wide knowledge of pumping, heat-exchange equipment and instrumentation, and the appointment offers excellent prospects to suitable men. Applicants should write fully, stating qualifications, age and experience to **FOSTER WHEELER LTD., 3, Ixworth Place, London, S.W.3.**

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THE MINISTRY OF SUPPLY requires an **INDUSTRIAL RESEARCH CHEMIST** of experience and ability to take charge of the applied Research Laboratories in the Division of Atomic Energy (Production) at Seascale in Cumberland.

The successful candidate will first be required to build up a large staff of university graduates and assistants. He will then be responsible for directing and executing the whole of the applied chemical research work required to devise new and improve existing processes in connection with the production of fissile materials.

Candidates must have an honours degree in Chemistry and experience of managing an industrial research department.

The salary offered is £2,200 a year with F.S.S.U. Benefits. Applications to be addressed to **D. AT.EN. (P), Risley, Nr. Warrington, Lancashire.**
Rs. 784.30.13.6.50.MA.

FOR SALE

VARIOUS MIXERS FOR SALE

No. 200 ONE nearly new **WERNER PFLEIDERER JACKETED MIXER OR INCORPORATOR.** Low type, with C.I. built mixing chamber, 28 in. by 29 in. by 27 in. deep, with double "U"-shaped bottom which is jacketed, and double fish-tail or fin-type agitators geared together at one side, with belt-driven friction pulleys, 34 in. diam. by 5 in. face, with hand-wheel operation and hand-operated screw tilting gear. Machine fitted with machine-cut gears, covers, gear guard, cast-iron baseplate, and measuring overall approximately 7 ft. by 6 ft. by 4 ft. high to the top of the tipping screw

No 204 One **WERNER PFLEIDERER MIXER OR INCORPORATOR,** similar to the above, with a C.I. built pan 25 in. by 25 in. by 19 in. deep, belt pulleys 26 in. diam. by 5 in. face, double fin-type agitators, and mounted on C.I. legs.

No. 205 One larger **WERNER-TYPE MIXER OR INCORPORATOR,** by Dobson & Barlow, with C.I. built pan or mixing chamber, of the double "U" type, 4 ft. 6 in. by 3 ft. 7 in. by 3 ft. 10 in. deep, with a jacketed bottom and sides to within about 12 in. of top, and fitted with double "Z" type agitators, counterbalanced cover, machine-cut gears at each side, steel back-frame with counterbalancing weights and self-contained belt-driven tipping gear and main triple fast and loose belt pulleys 30 in. diam. by 6½ in. face, with belt fork. Approximate overall sizes, 12 ft. long by 8 ft. wide by 10 ft. high.

No. 206 One **DITTO** of the same pattern, by **DOBSON & BARLOW**

No 208 One **DITTO** by **WERNER PFLEIDERER,** with a C.I. built pan or mixing chamber, of the double "U" type, 4 ft. 5 in. long by 3 ft. 8 in. by 33 in. deep, with double "Z" mixing arms, gears at each end, hand-operated tilting gear, with steel backframe, counterbalancing weights and chains, and fast and loose pulleys 3 ft. diam. by 6 in. face.

No. 209 One **HORIZONTAL "U"-SHAPED MIXER,** steel built, riveted, measuring about 8 ft. 3 in. long by 3 ft. wide by 3ft. 3 in. deep, with horizontal shaft, fitted with bolted-on mixing arms about 18 in. long by 4 in. wide, with intermediate breakers, and driven at one end by a pair of spur gears, with countershaft, fast and loose belt pulleys, outer bearing and plug cock type outlet at the opposite end, mounted on two cradles fitted to two R.S.J. running from end to end.

No. 210 One **HORIZONTAL MIXER** as above.

No. 211 One **HORIZONTAL MIXER** as above.

These three "U"-shaped mixers are in some cases fitted with steel plate covers and a steam jacket round the bottom and extending to within about 18 in. of the top with plain end plates.

Further details and prices upon application

Write RICHARD SIZER LIMITED, ENGINEERS CUBER WORKS HULL.

INDUSTRIAL all copper, **SOLVENT RECOVERY ABSORBERS,** by Acticarbone. Apply, **British Rayophane Ltd., Wigton, Cumberland.**

FOR SALE

600

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CARTON FILLING, PACKING, WRAPPING AND LABELLING MACHINE by **SOCIETE INDUSTRIELLE SUISSE,** adjustable for cartons from 73 mm. sq. by 38 mm. to 65.6 mm. sq. by 38 mm. Motorised 400/3/50. Complete with label attachments and heat sealing device. Conveyor feed approx. 55 per min.

TROUGH MIXER/DRYER by **SIMON,** horiz., int. dimens., 8 ft. by 2 ft. 6 in. deep by 2 ft. 8 in. wide. Agitator comprises bank of 16 solid drawn tubes, approx. 6 ft. 6 in. long by 2½ in. o.d. Chain and sprocket drive, 8 in. square bottom side discharge.

Two **EVAPORATING AND DISTILLING PLANTS** by **G. & J. WEIR,** new 1945. Capacity 100 tons each, fresh water in 24 hours. Evaporators, 6 ft. 9 in. high by 30 in. diam. 10 banks copper steam coils secured in C.I. header easily removed by opening inspection doors (spare coils available). Each unit complete with distiller condenser, 2 ft. diam. by 4 ft. 10 in. Cooler condenser, 9 in. diam. by 4 ft. 10 in. One evaporating reciprocating steam driven combination pump dealing with feed discharge and vacuum, and one steam driven reciprocating circulating water pump. Interconnecting piping not included.

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Six **JACKETED MIXERS** by **BAKER PERKINS,** trough, 31 in. by 28½ in. by 28 in., twin Naben type blade agitators. Hand op. tilting. Trough fitted aluminium cover. Direct drive by T/E geared B.T.H. motor, 400/440/3/50.

Three double trough type **JACKETED MIXERS** by **WERNER PFLEIDERER,** trough 24½ in. by 24½ in. by 19½ in. deep, fitted double fin type agitators. Driven at variable speeds through single machine cut gearing from clutch op. driving and reversing pulleys. Hand op. tilting. Agitators can be used whilst tilting. 10/15 h.p. required to drive.

Eight double trough type **JACKETED MIXERS** by **WERNER PFLEIDERER.** Int. dimens., 2 ft. 4½ in. by 2 ft. 5 in. by 2 ft. 3½ in. deep. Fitted twin double fin type agitators, driven through gearing by pulleys. Hand op. tilting. 10/15 h.p. required to drive.

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